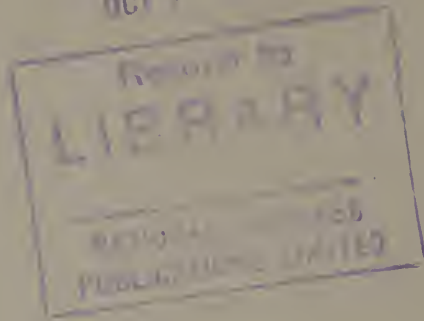
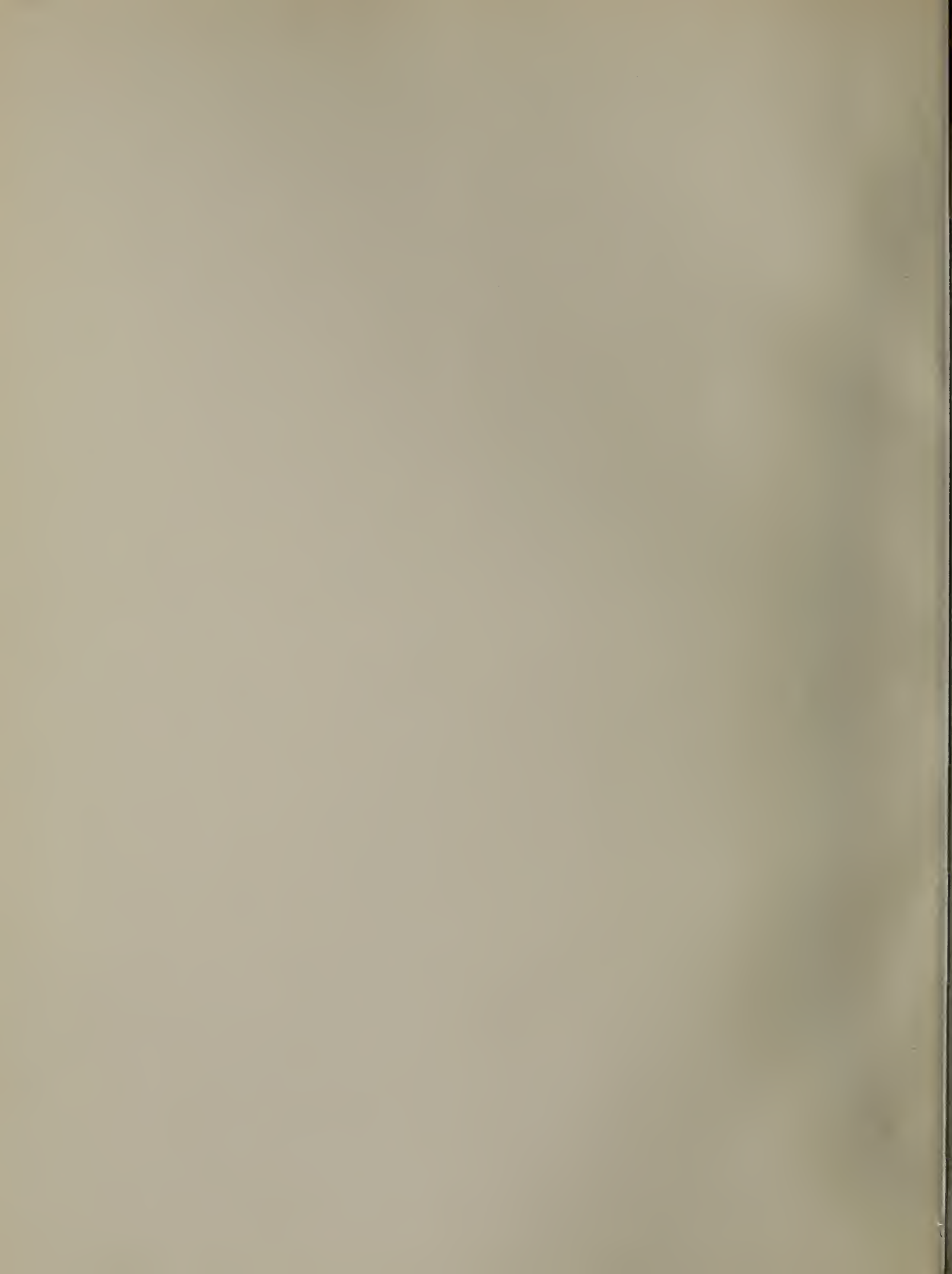


OCT 7 1965



DOCS 1-100

Return to
LIBRARY
NATIONAL ARCHIVES
PUBLICATIONS UNIT



MINING REVIEW

Canadian

Established 1882

Vol. VIII.—No. I.

1889.—OTTAWA, JANUARY—1889.

Vol. VIII.—No. I

THE STANDARD AMERICAN ROCK DRILLING
and AIR COMPRESSING MACHINERY.

WRITE TO US.

ROCK DRILLS
AIR COMPRESSORS &
GENERAL MACHINERY FOR
MINING, TUNNELING,
QUARRY & RAILROAD WORK.
RAND DRILL CO 23 PARK PLACE NEW YORK

SEND FOR CATALOGUE.

The Highest American Tunneling Record.

Hamilton Powder

COMPANY,

Manufacture Mining, Blasting, Military
and Sporting

Gunpowder,

DYNAMITE, DAULIN, and the new

ECLIPSE MINING POWDER

DOMINION AGENTS FOR

Safety Fuse, Electric Blasting
Apparatus, &c.

OFFICE

103 ST. FRANCOIS XAVIER STREET
MONTREAL.

BRANCH OFFICES & MAGAZINES
at all chief distributing points
in Canada.

CANADA ATLANTIC RAILWAY.

THE SHORTEST PASSENGER ROUTE
BETWEEN

Ottawa and Montreal,

AND ALL POINTS EAST & SOUTH.

The only road in Canada running trains lighted
with electricity and heated by steam from the
engine. Luxurious Buffet Pullman Palace Cars
on all trains between Ottawa and Montreal. Only
line running through Sleeping Cars between

Ottawa, Boston and New York

And all New England and New York points.

Baggage checked to all points and passed by Cus-
toms in transit.

During season of navigation close connections
are made with Richelieu and Ontario Navigation
Company's Steamers at Coteau Landing, shooting
the St. Lawrence Rapids.

For Tickets, Time Tables and information apply
to nearest agent, or to

S. EBBS, City Passenger Agent,
24 Sparks St., OTTAWA.

GEO. H. PHILLIPS, Gen. Agent,
VALLEYFIELD.

A. E. CAIRNS, General Agent,
136 St. James St., MONTREAL.

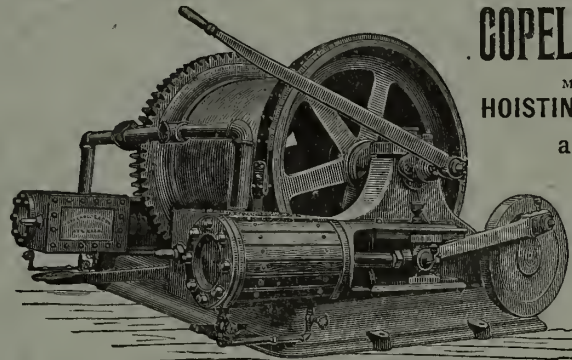
Or at 260 Washington St., Boston, and
317 Broadway, New York.

PERCY R. TODD,

General Passenger Agent.

E. J. CHAMBERLIN,

General Manager,
General Offices, Ottawa.



COPELAND & BACON

MANUFACTURERS OF
HOISTING ENGINES,
and MINING PLANTS.

85 Liberty St.

NEW YORK.

Send for Catalogue.

MILLER BROS. & MITCHELL

MANUFACTURERS OF

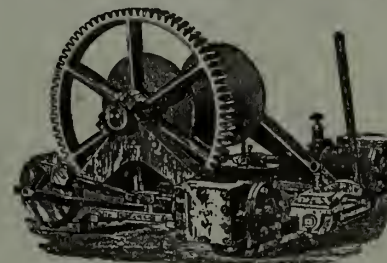
Steam Rock Drills

AND

HOISTING ENGINES,

Mining & Contractors' Plant.
&c., &c.

110 TO 120 KING STREET, MONTREAL, QUE.



THE

BELL TELEPHONE CO.

OF CANADA.

ANDREW ROBERTSON, . . . PRESIDENT

C. F. SISE, . . . VICE-PRESIDENT

C. P. SCLATER, . . . SECRETARY-TREASURER

HEAD OFFICE, - MONTREAL.

H. C. BAKER, Manager Ontario Department,
HAMILTON.

This Company will sell its instruments at prices
ranging from \$10 to \$25 per set. These instru-
ments are under the protection of the Company's
patents, and purchasers are therefore entirely free
from risk of litigation.

This Company will arrange to connect places
not having telegraphic facilities with the nearest
telegraph office, or it will build private lines for
firms or individuals, connecting their places of
business or residences. It is also prepared to
manufacture all kinds of electrical apparatus.

Full particulars can be obtained the at Com-
pany's offices as above, or at St. John, N.B., Hal-
ifax, N.S., Winnipeg, Man., Victoria, B.C.



MISS M. E. ORR.

REMINGTON

STANDARD

TYPEWRITER

Miss Orr, Championship
of the world and Gold Medal
at Toronto, 13th August,
1888.

GEORGE BENGOUGH,

GENERAL AGENT,

36 King Street, TORONTO.

ALEX. FLECK, JUN.,

Manufacturer of every Description of

Mill Machinery,

Water Wheels, Steam Engines,
Boilers, Derrieks, Steam
Pumps and Mining
Machinery.

Brass and Iron Casting of every
Description.

VULCAN IRON WORKS, WELLINGTON ST
OTTAWA.

DYNAMO ELECTRIC

MACHINES and LAMPS



THE
BALL ELECTRIC LIGHT CO. LD.
MANUFACTURERS OF

ELECTRIC LIGHTING APPARATUS
57, ADELAIDE ST. W.
TORONTO
ONT.

ARC and INCANDESCENT

FOR MINING PURPOSES

THIS SPACE OPEN TO CONTRACT.

LIDGERWOOD MANUF'G CO.

96 LIBERTY ST, NEW YORK,

Largest Manufacturers in the United States of Hoisting Machinery of Every Description for Mines, Tunnel Work, Contractors, and General Hoisting Purposes.

IMPROVED HOISTING ENGINES

FOR MINING PURPOSES A SPECIALTY.

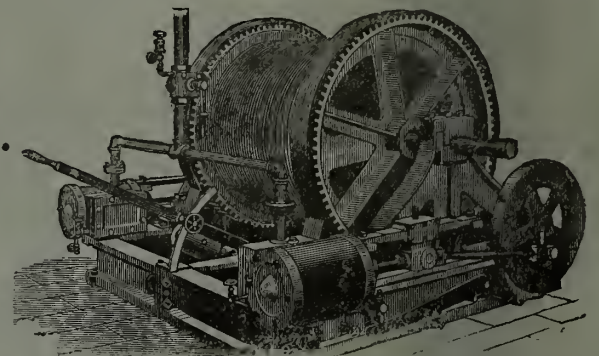
Over 5,000 Engines in Use!

300 Styles
and Sizes.

Send for
CATALOGUE.



FRICTION DRUM PORTABLE HOISTING ENGINE.



Double Cylinder Reversible Mine Engine.

New York Belting & Packing Co.

15 PARK ROW, NEW YORK

JOHN H. CHEEVER, Treasurer.

J. D. CHEEVER, Dep'y Treasurer.

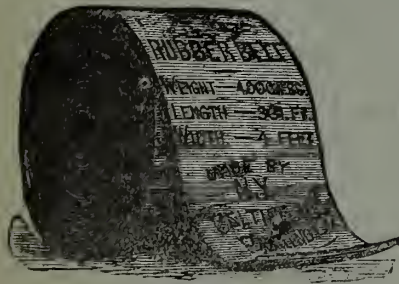
Oldest and largest Manufacturers in the United States of

VULCANIZED RUBBER FABRICS

FOR MECHANICAL PURPOSES.

EXTRA RUBBER BELTING AND HOSE

FOR MINING PURPOSES.



RUBBER BELTING.

CIRCULAR WOVEN SEAMLESS, ANTI-SEPTIC RUBBER LINED

"CABLE" HOSE and TEST HOSE

For the use of Steam Engines, Force Pumps, Rolling Mills, Iron Works, Factories, etc. Woven in a superior manner to insure wear, compactness and durability.



"TEST HOSE."



Emery Vulcanite Wheel.

SOLID VULCANITE EMERY WHEELS

(Large Wheels made on iron centers)

Cuts Cooler and Freer than any other other wheel in the market.

W. D. ALLAN & CO.,
151 Lake St., Chicago.

European Branch: Pickhuben, 5, Hamburg (Freihafengebeit), Germany.

H. D. EDWARDS & CO.,
Detroit.

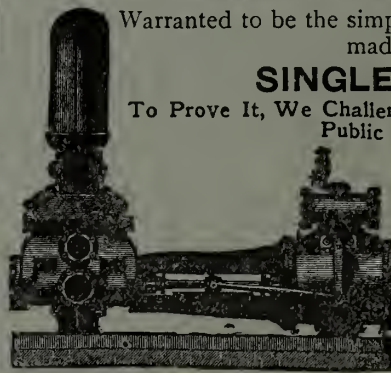
The M. T. DAVIDSON

IMPROVED MINING PUMP.

Warranted to be the simplest and most efficient Steam Pump made, whether it be

SINGLE OR DUPLEX.

To Prove It, We Challenge All Makers of Steam Pumps to a Public Competitive Test.



COMPOUND PUMPING ENGINES,

Obtaining a higher duty than any direct-acting pump made.

MANUFACTURED BY THE

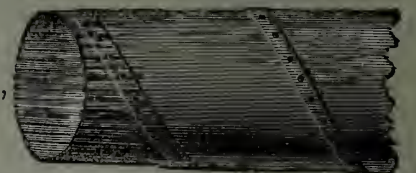
Davidson Steam Pump
COMPANY,

New York Office, - - - 77 Liberty Street.

ROOT'S SPIRAL RIVETED PIPE

FOR

Hydraulic Mining,
Water Works,
Ranch and Railroad
Water Supplies.



From 2 to 24 inches in diameter and 1 to 25 in length. Manufactured with fittings to suit, capable of withstanding any desired pressure.

ABENDROTH & ROOT MFG. CO.

28 Cliff Street, New York.

Chicago Branch, - - SMITH & KNAPP, 312 Dearborn Street

Francis D. Taylor
MINING ENGINEER,
ROCKVILLE, - ONTARIO

SPECIALTY. — The Mining of Iron Ores,
and the Manufacture of Iron and Steel.
Mr. T. has had for many years the manage-
ment of large mining enterprises in England
and the U. S. A.

CAMERON STEAM PUMP
SIMPLE, RELIABLE, COMPACT, DURABLE.
NO OUTSIDE VALVE GEAR.
ADAPTED FOR ALL PURPOSES.
THE A.S. CAMERON STEAM PUMP WORKS.
FOOT OF EAST 23rd STREET, NEW YORK.



J. STEWART,
Provincial Land Surveyor,
AND
CIVIL ENGINEER,
Office: — Over H. F. MacCarthy's Drug Store,
Wellington St., Ottawa, Ont.

TAYLOR McVEITY,
Barrister, Solicitor, &c.,
Supreme Court and Departmental Agent,
SCOTTISH ONTARIO CHAMBERS, OTTAWA.

WM. HAMILTON MERRITT, F.G.S.
Associate Royal School of Mines, &c.,
Mining Engineer and Metallurgist,
Will report on Mines and Mineral Properties.
ADDRESS:
15 TORONTO ST., TORONTO, ONT.

J. T. DONALD, M.A.,
Analytical Chemist and Assayer,
124 St. JAMES St. - MONTREAL.
Analyses and Assays of every description. Manufactur-
ing processes practically tested. Laboratory instruction
in Chemistry, Assaying and Mineralogy. Terms on
application.

SCIENTIFIC AMERICAN
ESTABLISHED 1845.
Is the oldest and most popular scientific and
mechanical paper published and has the largest
circulation of any paper of its class in the world.
Fully illustrated. Best class of Wood Engrav-
ings. Published weekly. Send for specimen
copy. Price \$3 a year. Four months' trial, \$1.
MUNN & CO., PUBLISHERS, 361 Broadway, N. Y.

ARCHITECTS & BUILDERS
Edition of Scientific American.
A great success. Each issue contains colored
lithographic plates of country and city residen-
ces or public buildings. Numerous engravings
and full plans and specifications for the use of
such as contemplate building. Price \$2.50 a year,
25 cts. a copy. MUNN & CO., PUBLISHERS.

PATENTS may be secur-
ed by apply-
ing to MUNN
& Co., who
have had over
40 years' experience and have made over
100,000 applications for American and For-
eign patents. Send for Handbook. Corre-
spondence strictly confidential.

TRADE MARKS.
In case your mark is not registered in the Pat-
ent Office, apply to MUNN & CO., and procure
immediate protection. Send for Handbook.
COPYRIGHTS for books, charts, maps,
etc., quickly procured. Address
MUNN & CO., Patent Solicitors,
GENERAL OFFICE, 361 BROADWAY, N. Y.



ONTARIO Mining Regulations.

The following summary of the principal
provisions of the General Mining Act of
the Province of Ontario is published for
the information of those interested in
mining matters in the Algoma District,
and that part of the Nipissing District
north of the Mattawan River, Lake Nipis-
sing and French River.

Any person or persons may explore for
mines or minerals on any Crown Lands
surveyed or unsurveyed, not marked or
staked out or occupied.

The price of all lands sold as mining
locations or as lots in surveyed townships
is two dollars per acre cash, the pine timber
being reserved to the Crown. Patentees
or those claiming under them may cut and
use such trees as may be necessary for
building, fencing or fuel, or for any other
purpose essential to the working of mines.

Mining locations in unsurveyed territory
shall be rectangular in shape, and the
bearings of the outlines thereof shall be due
north and south, and due east and west
astronomically, and such locations shall be
one of the following dimensions, viz: eighty
chains in length by forty chains in width,
containing 320 acres, or forty chains square,
containing 160 acres, or forty chains in
length by twenty chains in width, con-
taining 80 acres.

All such locations must be surveyed by
a Provincial Land Surveyor, and be con-
nected with some known point or boundary
at the cost of the applicant, who must file
with application surveyor's plan, field notes
and description of location applied for.

In all patents for mining locations a
reservation of five per cent. of the acreage
is made for roads.

Lands patented under the Mining Act
are free from all royalties or duties in re-
spect to any ores or minerals thereon, and
no reservation or exception of any mineral
is made in the patents.

Lands situated south of the Mattawan
River, Lake Nipissing and French River
are sold under the Mining Act at one
dollar per acre cash.

Affidavits showing no adverse occupa-
tion, improvement or claim should ac-
company applications to purchase.

T. B. PARDEE,

Commissioner
Department of Crown Lands, Toronto.

The Canada Co.

Will issue Licences to Prospect or
to work Minerals on any of
their Mining Lands and
Mineral Reservations,

Covering nearly a

Quarter of a Million Acres

In Eastern Ontario, and principally
within the belts containing
Iron, Phosphate, Gold, Galena
Plumbago, Mica, Marbles,
Building Stone,
and other valuable Minerals.

For list of lands and terms apply to the
Company's Mining Inspectors,

H. T. STRICKLAND,
Peterborough, Ont.,

for lands in the County of Hastings and
westward, and to

ANDREW BELL, P.L.S.,
Almonte, Ont.,

for lands East of the County of Hastings.

TO MINERS AND OTHERS.

Bannerman & Powers,

VULCAN BOILER WORKS,

428 and 340 Wellington St., Ottawa.

MANUFACTURERS OF

IRON AND STEEL BOILERS

OF EVERY DESCRIPTION.

Tanks, Girders, Iron Roof-
ing, Bank Vaults, Smoke
Stacks

—AND ALL KINDS OF—

SHEET IRON WORK.

Repairs Neatly and Promptly Executed

Queen City Galvanizing Works,

SOLE MANUFACTURERS IN CANADA OF



WALTER'S
PATENT

Metallic Shingle

—AND—
SIDING PLATES.

Fire and Storm Proof. Easily ap-
plied. Make the handsomest roof known
and give double the service of the same
material put on by any other method.
Send for particulars.

Thomas McDonald & Co.,

69 to 75 Sherbourne St., Toronto, Ont.

PORTABLE ENGINES AND SAW-MILLS

Of all capacities—from 3000 feet of lumber and up per day.

Saw-Mills.

Shingle-Mills.

Lath-Mills.

Chopping-Mills.

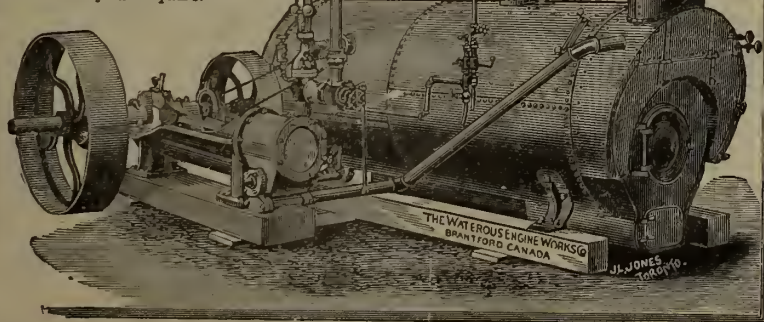
ENGINES

OF ALL SIZES.

BOILERS

of all capacities,
IRON OR STEEL,
ALL STYLES.

Send for Circulars, stating
what you require.



Waterous Engine Works Co. Brantford, Canada.
St. Paul, Minn., U.S.A.

A Narrow Escape.—Hugh McKeever, a quarryman at Verplanck's, N. Y., celebrated Harrison's election by exploding dynamite cartridges at a safe distance from his house. When it began to rain hard he entered his house, still having one of the dynamite cartridges in his possession. He touched the fuse to the fire in his pipe and attempted to throw the cartridge out of the door. It struck against the woodwork and fell back in the room. McKeever ran into an adjoining room, where his two children, Hugh, aged thirteen, and Lizzie, aged eleven, were in bed. He threw himself on the bed and covered his head with the bed clothing. When the cartridge exploded it tore out the front and rear of the house, demolished the doors and windows and badly wrecked the furniture. The bed on which were McKeever and his two children, was blown through the side of the house, but none of them were seriously hurt. The house was completely wrecked.

DYNAMITE.

AND OTHER EXPLOSIVES.

FINE CAST STEEL For Rock Drilling and all other Mining
Material constantly on hand.

McDOUGALL & CUZNER,

531 Sussex and 35 Duke Streets, OTTAWA.

A No. 1 Phosphate Property

ON RIDEAU LAKE

FOR SALE OR LEASE.

On favorable terms to party with not less than \$5,000 capital.
Highest grade mineral and inexhaustible quantity.

N. S. BENTLEY, 45 William St., New York.

W. Bredmeyer, Dr. Ph.

(LATE PARTNER OF JOHN McVICKER)

Mining Engineer, United States Surveyor and Assayer,

MASONIC TEMPLE BLOCK, VANCOUVER, B.C.

RELIABLE REPORTS, underground surveys and maps of mines executed at low rates. Assays made on all kinds of minerals, Gold and Silver Bars. Thirty years' experience in mining in Asia, Europe and United States of America. Speaks ten languages. Assays from a distance promptly attended to.
Address Vancouver, B.C.

Ottawa Boiler and Bridge Works

478-480-482 } OTTAWA { 476-478-480
Maria St. } Gloucester St.

W. J. CAMPBELL & CO

MANUFACTURERS OF

STEAM ENGINES, BOILERS,
TANKS, MINING PAILS,
DUMP-CARS

And every description of Wrought
Iron Work.

MINING WORK A SPECIALTY.

N.B.—Every Attention given to repairing by Experienced Workmen.

JAMES HOPE & CO.
BOOKSELLERS,

Stationers, Bookbinders and Printers,
OTTAWA.

Vancouver Coal Mining and Land Company.—Commenting upon the agreement recently made by this company and the Messrs. Rosenfeld the *Financial News* says: "Hope deferred seems to have made the hearts of the directors of the Vancouver Coal Mining and Land Company sick, for they are apparently anxious to give up the business just as the horizon is brightening. They have had to struggle for several years against adverse circumstances, which have made dividends scarce, none having been paid since December, 1880. Last year there was a serious explosion in the company's mines which did not improve matters. As a result the debit balance of the company reached the sum of £20,985. The operations of the half year ending with June have been sufficiently profitable to wipe out this accumulated deficit all but £127. It must be noted that, in spite of the troubles which have beset the company, it has never failed to pay interest on its debentures and to make ample allowance for depreciation, so that whenever the corner should be turned there should be no burden to be cleared off save the simple deficit. It is necessary to remember this when considering the conditional arrangements now made by the directors for selling the property. Were the company embarrassed beyond recovery it would be easy to understand the motives which inspire the board, but in the light of the report presented to the shareholders upon December 4 the proposal of the directors is a little mysterious."

Endless Rope Haulage.—Mr. Thomas Henry Bailey read a most interesting paper on the subject of endless rope haulage before a recent meeting of the of South Wales, Institute of Engineers at Cardiff. In the course of this he showed that the importance of efficient haulage to the mining industry of the present day could scarcely be over-estimated, as the coal easily reached near the surface had been exhausted in most of the large coal fields of the country, and at the greater depths now necessary colliery owners were compelled to adopt various systems of underground haulage. The two most important features with reference to efficient haulage were the gradient and the friction of the conveyance carrying the load. The particular method under description was that known as the "endless rope" system, which had been laid down in the South Duffryn Colliery at the Plymouth Works, Merthyr Tydfil. A packing of sand behind a brickwork lining of the archway was found to be a sure means of preventing local pressure from the surrounding strata. The whole of the underground engines and pumps required were worked by compressed air. In the Plymouth colliery the rope was carried under the trams or tubs, and the other disadvantage of the system was that to apply it economically two lines of railway were required, and consequently very wide roads were needed to accommodate the large trams used in South Wales. The hauling engines in use shewed a total indicated power of 18-horse power exerted on the cranks. At the time there were fifteen full trams and fifteen empty trams attached to the rope about forty yards apart, and the engines were making twenty revolutions per minute. The rope was travelling about one mile and one-third per hour. Several members followed in discussion, and agreed that the system was excellent if it was cheap. Mr. Bailey promised to give particulars as to cost at the next meeting, and the discussion was adjourned.

W. Blakemore, F.G.S., M.E.,
Member of I. & S.I.

A. Montgomery Evans, M.E.,
of Canada & U.S.

BLAKEMORE & EVANS, MINING & CIVIL ENGINEERS Exchange Buildings, Cardiff, S.W.

LONDON OFFICE:

Robert H. Jones, 82 Queen St., Cheapside, London, E.C.

Reports, Estimates, and Valuations made on Iron and Steel Works,
Blast Furnaces, and all classes of Mining Properties.

CANADIAN BUSINESS PROMPTLY ATTENDED TO.

To Prevent Boiler Explosions

And other accidents to steam boilers, and to secure
economy in working, insure with

THE BOILER INSPECTION AND INSURANCE COMPANY OF CANADA.

Sir Alex. Campbell, K.C.M.G., | John L. Blaikie, Esq.
President. | Vice-Pres.

HEAD OFFICE: - - - - - TORONTO.

G. C. ROBB, Chief Engineer.

A. FRASER, Sec'y-Treas.

ORFORD COPPER CO., COPPER SMELTERS.

Works at Constable's Hook, N.J., opposite new Brighton, Staten Island. Copper Ore, Mattes, or Bullion purchased. Advances made on consignments for refining and sale. Specialty made of Silver-Bearing Ores and Mattes.

SELL

INGOT AND CAKE COPPER.

President, ROBERT M. THOMPSON,

Treasurer, G. A. LAND.

Office, 37 to 39 Wall Street, New York.

Robin & Sadler,

MANUFACTURERS OF

LEATHER BELTING.

TRY OUR

Waterproof Belting,

Just the thing for Mining Machinery.

MONTREAL,

2518, 2520, 2522 Notre Dame St.

TORONTO,

129 Bay Street.

STEEL IN STORE "JESSOP'S"

Standard Durable Cast Steel. Best value for consumers.
Also Machinery Steel.

A. C. LESLIE & CO.,
Montreal and Toronto.

T. D. LEDYARD,
DEALER IN MINERAL LANDS
4 ONTARIO CHAMBERS, TORONTO.

Will buy undeveloped iron ore and other mineral properties.
WANTED. — Deposits of Magnetic Iron Ore, Red Hematite, Brown Hematite, Galena, Iron and Copper Pyrites, Mica, Soapstone, Marble, Gypsum, Baryta. Samples can be sent by Sample Post for 1 cent for 4 oz. or up to 24 oz. in weight.
Information regarding mines cheerfully given. Correspondence solicited. Crown Land Business attended to.

CHEMICAL APPARATUS! OF EVERY DESCRIPTION.



Glass, Porcelain, Stoneware, Platinum, Crucibles of every sort, Analytical Scales and Weights, Fine Chemicals and Reagents, including Volumetric Solutions. Every requisite for Analysis or Experiment. For Sale by

LYMAN, SONS & CO.,
384 St. Paul St., Montreal.

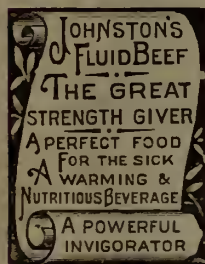
Illustrated Catalogue mailed on receipt of 10c. or Business Card.

Electric Lighting Craig System.

CRAIG & SONS—Constructors of Electric Light Apparatus for the Illumination of Cities, Towns, Villages, Public and Private Buildings, Mines, Workshops, etc. (by the Incandescent System). Also Electro-plating Apparatus, Material for Electric Light, etc.

CRAIG & SONS,
Ste. Cuneconde, Montreal.

A Serious Error



IN COOKING FOR THE SICK LIES IN THE METHOD OF PREPARING BEEF TEA

which deprives it of all its nutrition. It is customary to STRAIN the BOILED LIQUOR and deprive it of SCUM and RESIDUE.

PLEASE NOTE—That the SCUM is the ALBUMEN, the RESIDUE is the FIBRINE, and the CLEAR LIQUOR that is left has no

more nutritive power THAN A CUP OF COFFEE. The application of heat coagulates the albumen, which is the most important constituent of meat, and is insoluble in boiling water.

JOHNSTON'S FLUID BEEF

By its Patent Process of Manufacture RETAINS ALL THE ALBUMEN, the FIBRINE and the PHOSPHATES. In fact it contains all the valuable ingredients THAT EXIST IN THE MEAT ITSELF.

Victor Electric Fuses.

Superior to all others for Exploding any make of Dynamite, High Explosives, or Gelatine Powder. Each Fuse is tested and warranted extra strong and waterproof. Low grades of Dynamite Powder will do ten per cent. more execution if detonated with Victor Electric Fuses.

VICTOR BLASTING MACHINES.

Latest improvements, made in three sizes, easy to operate, strong and durable. No expensive repairs, low in price, will fire any make of Electric Fuses.

MANUFACTURED ONLY BY

JAMES MACBETH & CO.,

128 Maiden Lane, N.Y., U.S.A.

Send for Catalogue.

FOR SALE.

A COAL MINE IN CAPE BRETON,

Area, 970 acres, underlaid by 6 or 7 beds of the best Coal in Nova Scotia. The property is estimated to contain from 50 to 60 million tons of Coal. No Coal Mine can be more easily or cheaply operated. The angle of dip is 6 degrees, and the rock stratification is remarkably even and without fault or break.

Apply to

ALEXANDER CAMPBELL,
Annapolis Royal, N.S.

12th, 1888.

A New Ore Roaster.—An ore roasting furnace has been patented by Albert C. Johnson, of Wilmington, Del. It is for desulphurising copper ores, iron pyrites, gold bearing sulphurets and other ores, and is provided with different compartments in which are placed raking bars of novel construction, the ore to be gradually moved from one compartment to the other, and agitated in each compartment by the raking teeth or fingers, which also impart an outward or inward motion to the ore.

Electric Motors for Underground Haulage.—In a paper read the other day at a meeting of mining engineers, in South Wales, Mr. J. Fox Tallis dealt with the application of electricity to underground haulage, and came to the conclusion that the electric motor was the best means for underground hauling. The author, however, did not consider that locomotive motors were practicable. This view is quite opposed to that held by Mr. A. W. Sheaffer, who in June last read a paper on the same subject to the Engineers' Club of Philadelphia. In it he pointed out that nine locomotives are very objectionable on account of the danger to good ventilation caused by the noxious gases thrown off during the combustion of their fuel. In consequence of this they can only be used in the gangways carrying the return current. He points out that the electric locomotive avoid this, as well as other objections, and states that the Lykens Valley Coal Company, at their mines in Dauphin County, have introduced the electric locomotives with considerable success. The comparison between the cost of mule, steam, and electric haulage is given as follows:—Cost per ton per mile 1-82-100 cents, and 4-10 to 67-100 cents, respectively. An electric railway has also been established since January, 1884, in the Neu-Stassfurt Saltworks, and has been decidedly successful. The plant was made by Messrs. Siemens and Halske, of Berlin and Vienna.

Mines and Mineral Resources of India.—Out of 105 collieries there were 69 at work during the years 1886-7. They employed 24,794 hands, as compared with 22,745 in the previous year, and the total output of coal rose from 1,294,221 tons to 1,388,487 tons. The total imports of coal from Europe and Australia during the year were 765,668 tons. The largest proportional increase took place at the Assam and Umeria coal fields. The Nizam's Railway has now reached the Singareni coal fields, in the Kistna valley, so that before long that coal will displace imported coal on the Hyderabad Railway and on the Madras railway system. Arrangements are being made for using coal from the Dandot mine on a part of the Punjab railway system, and investigations are being made into the three known coal-bearing areas of Upper Burmah. The Chindwin coal is already used to some extent on river steamers. Coal from the Assam mines is said to have come into the Calcutta market, and to fetch as much as 14 rupees per ton. Iron is worked to a limited extent, after native methods, in all provinces and in many districts. The Barrakur Iron Works, which have, within a radius of five miles excellent coal, iron, and lime, did not pay during the year, the stock of pig iron rose from 677 tons to 3,683 tons and there were few buyers. Everywhere English iron is in common use, and generally undersells the local product.

ALEX. RANKIN,

20 Toronto Street, Toronto Ont.

Agent for sale of Mines and Mineral Lands

CORRESPONDENCE SOLICITED.

Agents in England and New York.

FOR SALE.

Second-Hand Mining Machinery.

7 Drill Ingersoll Air Compressor.

80 H.P. Return Tubular Boiler.

Ingersoll Rook Drills, &c.

All equal to new; for sale at large reductions.

ADDRESS P.O. BOX 6. MONTREAL.

Fred. J. Penfold,

COATICOOK, QUE.

REAL ESTATE & FINANCIAL AGENT

Special attention given to Mining properties, having unusual facilities for disposing of same if really good. Shipper of Butter and Cheese to England; liberal advances made thereon. Money to loan on first mortgage or other property of any description. Valuable Copper Mine on hand for sale.

E. H. SARGENT & CO.,

IMPORTERS AND DEALERS IN

ASSAYER'S MATERIALS,

Chemicals and Laboratory Supplies.

125 State Street,

CHICAGO.

THIS YEAR'S

MYRTLE

CUT AND PLUG

Smoking Tobacco

FINER THAN EVER.

SEE

T & B

In Bronze on Each Plug and Package.

THE DOMINION

SAFETY BOILER CO.

MANUFACTURERS OF

The "Field-Stirling" Patent High Pressure Boiler,

The Safest and Cheapest Steam-Generator now in Use.

This Boiler is unusually durable, being made of the best steel and wrought iron exclusively. No cast-iron is employed. It is simple in construction, has a rapid, well-defined circulation, and a large cool mud-drum, where all impurities are collected to be blown off. All parts of the Boiler are readily accessible for the closest inspection. It has great excess of strength and is not liable to be strained by unequal expansion. The water space is divided into sections so arranged that NO EXPLOSION IS POSSIBLE.

Some of Our Leading Customers:

The J. A. Converse Mfg. Co. (A. W. Morris & Bro.), Montreal; The Canada Sugar Refining Co., Montreal; The Pillow and Hersey Mfg., Montreal; The Berthier Beet Root Sugar Co., Berthier, Que.; The Imperial Insurance Co., Montreal; The Massey Manufacturing Co., Toronto; The Acadia Coal Co. (Ld.), Stellarton, N.S.; Canada Paper Co., Windsor Mills, Que.; Royal Electric Co. (Central Station), Montreal; Dodge Wood Split Pulley Co., Toronto, and a repeat order from A. W. Morris & Bro., after five months' experience; Ingersoll Rock Drill Co. of Canada.

We guarantee Dry Steam and Great Economy of Fuel. Correspondence Solicited.

J. FRASER TORRANCE, M.E.,

P.O. Box 1707, Montreal.

Manager.

SPEIGHT & VanNOSTRAND,

*Dominion and Provincial Land Surveyors,
Draughtsmen, Valuers, &c.*

OFFICE: ROOM "J," FIRST FLOOR, TORONTO ARCADE,
YONGE ST., TORONTO.
Surveys, Plans, Descriptions of Properties, etc., promptly executed.
Timber Limits and Mining Claims Located.

MILLAR & CO.

General Merchants & Shipping Agents

ATLANTIC CHAMBERS,

209 COMMISSIONER ST., - MONTREAL

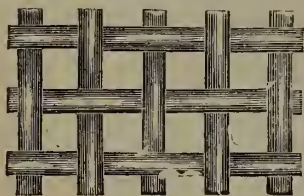
Cable address, "Hoyer, Montreal." P.O. Box 1095.

AGENT FOR The Canadian Phosphate Co., Ltd., of London, Eng.,
The Montreal Union Abattoir Co., of Montreal, Can.
English Correspondents Messrs. Couper, McCarnie & Co., London, England.

DEALERS IN Canada Phosphate, Ground Phosphate, Sulphate of
Ammonia, Nitrate of Soda, Spent Bone Black, Hoofs and
Horns, Fertilizers, Tankage, Dried Blood, Grease, Bones,
Hair, etc., etc., etc.



For Mining Hoisting Derricks, etc.

**Strong Wire Cloth and Screens**

For Mining, etc., manufactured by

B. Greening & Co.

HAMILTON, ONT.

NATIONAL COLONIZATION

Lottery!

UNDER THE PATRONAGE OF

THE REV. FATHER LABELLE.

Established in 1884 under the Act of Quebec, 31 Vict.,
Chap. 36, for the benefit of the Diocesan Societies
of Colonization of the Province of Quebec.

CLASS D.

DRAWINGS ON THIRD WEDNESDAY IN EVERY
MONTH AT 2 P.M.

Prizes value \$50,000

Capital Prize: 1 Real Estate worth \$5,000.

LIST OF PRIZES.

1 Real Estate worth	\$5,000	\$5,000
1 Real Estate worth	2,000	2,000
1 Real Estate worth	1,000	1,000
4 Real Estates	50	2,000
10 Real Estates	30	3,000
30 Furniture Sets	200	6,000
60 Furniture Sets	100	6,000
200 Gold Watches	50	10,000
1000 Silver Watches	10	10,000
1000 Toilet Sets	5	5,000

2307 Prizes worth

\$50,000

Tickets, \$1.00!

Offers are made to all winners to pay their prizes cash,
less a commission of 10 p. c. Winners' names not pub-
lished unless specially authorized.

S. E. LEFEBVRE, Secretary

Office: 19 St. James St., Montreal, Can.

The Salt Beds of South America.

The salt beds on the west coast of South America, according to the description of Dr. Carl Oehsenius, occur in a narrow strip along the coast line of the rainless district, rarely exceeding 25 miles in width. The district is bounded on the north by the Andes, and extends into the coast Cordilleras on the south. The author considers that, before the upheaval of the Andes, salt began to deposit in certain bays, which had been wholly or partially shut off from the sea by the gradual formation of an intercepting bar. Then, while the process of evaporation was yet incomplete, the district was raised by volcanic action, and the mother liquors from the salt lakes eventually escaped, running down into the valleys, and where they encountered no obstacle, reaching the sea. The coast of Cordilleras acted as a barrier in the southern portion of the district, while in the northern part the liquors doubtless returned to the sea. The volcanos which produced the upheaval exhaled immense quantities of carbonic acid gas, by the action of which a portion of the sodium chloride in the mother liquors was converted into sodium carbonate. The coast in this part of Chili is studded with small islands containing deposits of guano rich in ammonia. The guano dust is carried by the prevailing west winds far into the country, where, on exposure to the air at a warm temperature, it would gradually oxidise to nitrate, and, acting on the sodium carbonate, would form sodium nitrate, or Chili saltpetre.

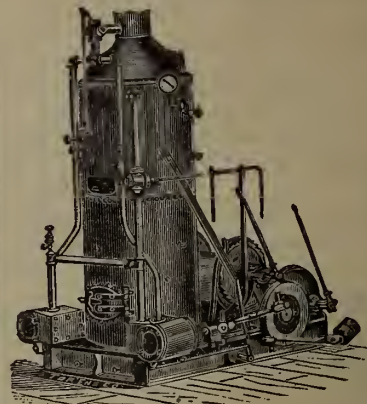
Asbestos in California.—One of the largest and most valuable deposits of asbestos in the world has recently been discovered in the Mojave country, not far from the line of the proposed Carson and Colorado railway between Keeler and Mojave. The mineral sources of this region have hitherto been considered worthless, except for the deposits of borax, soda and salt. The asbestos recently discovered near Oro Grande is as fine as has been found anywhere in the world, whilst the amount of mineral in the vein far exceeds that found in any other locality. The vein is about 25 ft. in thickness, and has been proved to extend for a distance of 1,500 ft., and is traceable for nearly three-quarters of a mile by croppings that occasionally come to the surface. Unlike many other asbestos deposits, this vein is almost unmixed with hornblende and tremolite. The fibres are long, silky and of a beautiful pearly lustre. The fibres are tough as flax, and are capable of being spun into a fine thread. Besides the fine fibrous asbestos which occupies the centre of the vein, there are on the outside great bodies of what is termed "rock cork," a variety of asbestos which is as easily cut and quite as light as ordinary cork, readily floating on water; also "rock wood" and "rock beaters," both of which are very similar to rock cork. In the same vein there appears to be an inexhaustible quantity of ordinary asbestos, such as is used for covering steam pipes, &c. The true amianthus is found in veins from 1 ft. to 4 ft. in thickness, and can be pulled out with the naked hand in tufts upwards of 3 ft. in length. Tale is also found in the same neighbourhood in immense quantities, and might be used for making firebricks and melting-pots mixed with asbestos, and no doubt when the Mojave country is opened up for the construction of the proposed Salt Lake City and Los Angeles Railway, the mineral resources of this hitherto unknown region will be fully developed.—*Society of Arts Journal.*

M. BEATTY & SONS,

WELLAND, ONT.

HOISTING
ENGINES

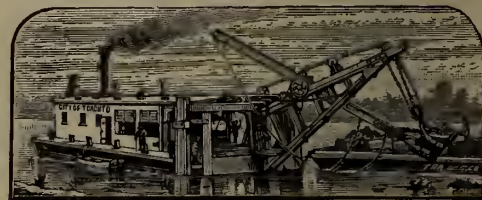
ENGINES
FOR
Mines
AND
Inclines



Horse-Power Hoisters,

Stone Derrick Irons,

Centrifugal Pumps.



DREDGES,

DERRICKS,

STEAM SHOVELS,

And other Contractors' Plant.

WORKS

—BY—

Professor E. J. CHAPMAN

Published by the COPP, CLARK CO. (LIMITED), TORONTO.

I.

MINERALS AND GEOLOGY OF CENTRAL CANADA,
COMPRISING THE PROVINCES OF ONTARIO AND QUEBEC.
Third Edition.

With 250 wood-cuts and a copious Index.

II.

AN OUTLINE OF THE GEOLOGY OF CANADA,
INCLUDING ALL THE PROVINCES OF THE DOMINION.
With six sketch-maps and six plates of characteristic fossils.

III.

BLOWPIPE PRACTICE.

WITH ORIGINAL TABLES FOR THE DETERMINATION OF
ALL KNOWN MINERALS.

This work has been favourably noticed in the 11th and 12th editions
of Von Kobell's celebrated *Tafeln zur Bestimmung
der Mineralien.*

IV.

PRACTICAL INSTRUCTIONS

FOR THE DETERMINATION BY FURNACE ASSAY OF GOLD AND
SILVER IN ROCKS AND ORES.
Second Edition.

V.

THE MINERAL INDICATOR:

A PRACTICAL GUIDE TO THE DETERMINATION OF GENERALLY-
OCCURRING MINERALS.

In preparation—A SYNOPSIS OF MINING GEOLOGY.

American Institute of Mining Engineers.

We take this opportunity of acknowledging with our best thanks, the courtesy of Mr. R. W. Raymond, Secretary of the American Institute of Mining Engineers, in sending us the advance sheets of the papers read before the October meeting of the Institute at Buffalo. We hope soon to be able to reproduce some of these valuable contributions to mining literature in our pages.

The Canadian Mining Review

CONDUCTED BY B. T. A. BELL

OFFICES:

UNION CHAMBERS, 14 Metcalfe St.

OTTAWA.

Vol. VIII. JANUARY, 1889. No. 1.

Provincial Mining Laws.

The present system, which permits the acquisition and control of large acreages of land upon payment of a merely nominal price, is undoubtedly a most favourable arrangement for capitalists and speculators, but is one that is in every way opposed to the interests of the people at large and to the development of our mining industries. Now, vast districts are locked up in a few hands, and no one desiring to operate upon them is permitted to do so unless he can afford to purchase the land at an immense advance upon its cost. In the financial centres there are numbers of men who have developed a passion for mining ventures and who are always ready to risk money in developing and working mines, but who will not lock up funds in the purchase of lands upon which they have to make the expensive outlay for so risky a venture as mining, or, as it has been aptly though somewhat profanely termed, "gambling with God." Everyone who has tried to influence capitalists to embark in mining ventures knows how easy it is to raise working capital alone compared with obtaining money for a scheme weighed down with a preliminary purchase of lands often at ten times the sum required for actual operations. In our phosphate districts cases have occurred where lands originally purchased from the Government for two or three dollars an acre have been resold at \$10, \$100 and as high as \$400 per acre. One tract bought for \$5,000 was resold at \$16,000, then at \$160,000, and part of it again for \$450,000. The sums required to pay interest on such large capitalization tend greatly to discourage investment, and the usual failure of mining enterprises loaded up with such a weight of dead outlay is the most serious check upon the development of mining industries.

If capitalists were permitted to lease upon royalty just as much land as they could work and only for such periods as they continued to work, or if the poor prospector could lease the acre on which he has found a valuable deposit and be at no expense beyond the cost of working, sharing his results with the people to whom the soil and its contents by natural right belong, then we should see a vast increase of mining operations, the revenue derived from royalties would be a constant and important source of income, and the people would cease to barter away their natural rights for a paltry "mess of pottage." It is pleasing to note that the Provincial Government of Quebec has decided to revise its Mining Act during the coming Session, while it is not at all improbable that the Report

of the Mining Commission will bring about many beneficial changes in the laws governing the disposal of mineral lands in Ontario.

A New Zealand Gold Mining Concern.

A company is now being formed in London, England, under the name of the "Island Block Gold Mining Co., Limited," for the purpose of mining on the Moa Flat Estate, on the Clutha, or Molyneux River, Otago, New Zealand, known as the Island Block.

The land over which the property extends is four miles in length, varying from 600 to 2,000 feet, and has an area of 800 acres.

From borings obtained by practical mining engineers at different parts of the bed of the river, gold was found in all the test holes yielding an average of about 13 grains to the ton. These holes varied from 22 to 42 feet in depth.

The formation consists of mica schists which has been denuded and carried down from the mountains forming the banks of the river.

The company is about to erect "Hydraulic Elevators" for the working of these deposits. They propose utilizing water, piped about 2½ miles in a direct line from the property, from an elevation of 600 feet or more.

It is claimed that "by the use of these elevators, four men can lift to a height of 60 feet, and sluice 1440 tons of wash dirt, sand and gravel, in eight hours, at a cost of less than one penny per ton, and that without steam or any complicated machinery, a force equal to 700 HP (continuous all the year round) is easily and cheaply obtained."

From the altitude of the supply of water, there can be no question as to the power obtained, as it exerts about 260 lbs pressure to the square inch.

But the quantity of material treated, viz.: 1440 tons, by four men in eight hours, is simply "prodigious," as it means 180 tons per hour, or 3 tons per minute.

Admitting that under the great pressure of water (which can be obtained) that the wash dirt, sand and gravel can be displaced, how, (in addition to this) this quantity is lifted to the height of 60 feet, and sluiced, so as to save the gold, by so small a force of men, is a matter that should be investigated in the interest of cheap and economic gold mining.

Then the question arises, how do they arrange their sluice so as to treat so great a quantity in the time above stated, and ensure successful amalgamation? For if the gold be "fine" and "flakey" (such as we have to contend with in western countries) it would be difficult to do this, as the quantity and velocity of the water necessary to properly sluice three tons of wash dirt, sand, gravel, etc., per minute would destroy the proper density, and would not admit of the "fine" and "flakey" gold being caught by the amalgam on the plates, or by the quicksilver in the traps, and it is well known by experience that "fine" and "flake" gold readily floats on

water, and if the water in the sluices be too dense and too heavily charged with the slimes, this difficulty is increased. It is also found that if the current be too swift in the sluice, loss of gold will follow.

Therefore, in view of these facts, it would be a matter of interest and instruction to know how this company treats successfully three tons per minute of low grade material carrying only 13 grains to the ton.

In conclusion, from statistics given, they claim that the cost for mining, elevating, amalgamating, management, quicksilver and other charges can be done for 6 cents per ton. If their practical work verifies this, it will reflect the greatest credit on the executive officers in charge.

English Fertilizer Trade.

The rise in phosphate prices is no doubt somewhat owing to the increased demand for fertilizers in England. The farmers appear to be more prosperous than they have been for some years past, and have been better able to pay for manures. The consequence is that all the manufacturers have been able to dispose of their products more fully than for several years.

This trade has been very much overdone in the past, and competition has reduced prices below a profitable point. The increased demand is inducing an effort among manufacturers to combine for higher prices, and if they succeed in this the producers of phosphate may come in for a share of the benefit. A private letter lately received from London says: "There is a very decided movement in England among the manure manufacturers to get better prices, and not before they need, for I am certain there has been a serious loss incurred by all in the trade, without any exception, all from over production and fighting against each other for what trade there has been. A very large meeting was held at the Cannon Street Hotel, and I hear there are some hopes of an understanding, but I don't think there is any chance of success as long as any makers will supply the Farmers' Associations. The fact is, an enterprising man turns up who may have been unfortunate in business; he sets to work and induces maybe a thousand farmers to subscribe one guinea each, which forms his salary. He then gets supplies from one or other of the manufacturers at the very lowest possible prices, and then not only supplies farmers at the cost, within a shilling or two, per ton, but advertises the members' prices in the various agricultural papers, thus at once spoiling the chance of all remunerative prices. He gets cash from all the well-to-do men, and leaves the needy at uncompensating prices for the other dealers and makers."

Our Canadian miners, who sometimes think they are victimized in their sales to English manufacturers, will see that the buyers in turn undergo commercial torture, and that the lesson of the day is conference, conciliation and combination among the workers of each department of industry and trade, in order that the strife of

commerce shall no longer be between individuals but between organized hosts. If users of fertilizers and the manufacturers are each associating to act in unison, it behoves producers of the raw material to likewise combine their forces and harmonize their efforts, and banish forever the suicidal individual strife and opposition among themselves which has too much governed the disposal of their products in the past; for if they have thus been an easy prey to the organized buyers, how can they withstand the united action of an associated industry? Let Canadian miners learn this lesson of the age speedily, and work intelligently and harmoniously together for the advancement of their common interests.

The Mineral Resources of the United States, 1887.

The annual report on "The Mineral Resources of the United States" for 1887 has just been issued by the Geological Survey at Washington, and comprises among the large amount of information contained therein, valuable remarks on and statistics of the production of numerous minerals and their products in Canada as well as in the United States. Under the head of copper, in which speculation has run riot of late, allusion is made to the Canadian Copper Company at Sudbury, Ont., which has developed "down to 300 feet, the existence of a large body of nickel copper ore." The smelting works there, erected by Dr. Edward D. Peters, are also referred to. A number of very valuable letters on the general copper industry are given. Manganese from Nova Scotia comes in for quite a share of notice, a table being given shewing the production of that ore in Nova Scotia from 1861 to 1887 inclusive. The report states that no returns have been obtained from New Brunswick. This seems to us a pity, as the Washington authorities give due prominence in this report to Canadian minerals which bear effect on trade with the United States.

Coal is mentioned as an import from British Columbia into California, and the amount produced in the former Province as well as in Nova Scotia is given in a table shewing the world's production of coal, but nothing is said of the amount of Nova Scotia coal used in the Eastern States, which is rather a curious omission.

The petroleum trade of Canada is dwelt upon at some length, statistics of production in and shipments from Canada being given. Some very interesting details accompany the remarks, both as regards capital invested, the extent of the works of some of the oil companies, and their capacity, and the tinworks connected therewith. These in one company alone own a plant which cost \$10,000 for manufacturing cans, mostly five-gallon capacity, and which being put up two in a case, are intended for transportation to the North-West, to British Columbia, and to the Maritime Provinces. The report winds up by saying, "there are no reliable statistics of production in Canada," and the figures given

are "the estimates of parties intimately connected with the industry."

The article on natural gas, by Mr. Joseph D. Weeks, contains much research, and is of great interest in connection with the excitement prevalent everywhere in connection with the search for this natural fuel, the use of which, for manufacturing purposes, has already in the United States been the means of saving a great consumption of coal, equal in 1887 to nearly ten million tons. Mr. Obalski's report on natural gas in Quebec has been condensed, and the most salient points of it are quoted *verbatim*. His report is spoken of as "a very thorough study of the conditions under which natural gas has been found."

Nova Scotia and New Brunswick both appear to contribute grindstones to the United States, but no figures are given to shew the amount of that trade. Apatite, as Canadian phosphate is termed in the report, is only referred to as shewing the quantity produced from 1878, and is apparently not yet in any great demand in the United States, the Canadian deposits affording most of the article used in their superphosphate works at present.

Gypsum, both in the crude state and as alabaster and spar ornaments, contributes a fair trade with the United States from Ontario, Nova Scotia and New Brunswick, Ontario contributing the smallest and Nova Scotia the greatest quantity. The production of graphite in Nova Scotia in 1887 was 300 tons, and it is stated that the production will doubtless be increased owing to "the interest of Americans in Canadian mines. It is practically all exported to the United States." A valuable report on Mineral Waters, by Mr. A. C. Peale, will be found very useful by those who seek information under that head, but none of the Canadian springs are mentioned. It appears from this article that the consumption of mineral water from springs is largely on the increase, whilst that of artificial waters is correspondingly diminishing.

The whole report is a most useful work of reference for any library, or for persons largely interested in mining matters. We are glad to see our own Geological Survey quoted as an authority, and the work originated on a similar basis to this United States report, although yet in its infancy, can be made to prove as valuable ultimately to Canadians, as the report now reviewed is to Americans generally. In conclusion we wish to remark that if all our own Government reports were as fully indexed as the volume before us, their value would be very much enhanced.

Canadian Phosphates in England.

Just as we go to press we are in receipt of a special cable from London stating that "Canadian phosphate deposits are receiving much attention among the agricultural classes, here in view of the threatened exhaustion of the Guano beds of Peru and Chili. The *Times* and *Morning Post* are drawing special attention to Ottawa County phosphates, declaring that the phosphate industry is only in its infancy in Canada, and urging British capitalists to provide for their further development.

LETTERS TO THE EDITOR.

We invite Correspondence upon matters consistent with the character of the REVIEW.

Be as brief as possible. The writers name in all cases required as a proof of good faith.

One dozen copies of the issue containing his communication will be mailed free to any correspondent on request.

We do not hold ourselves in any way responsible for the opinions expressed in this section of the REVIEW.

Rand Drill Test.

NEW YORK, January 9th, 1889.

The Editor

THE CANADIAN MINING REVIEW:

SIR,—In your issue of December, we observe a letter addressed by our aggressive friends the Rand Drill Company, in which, under the heading "Comparative Drill Test," they present a table giving the results in detail of a power drill test at the Ludington Mine.

In the first place, permit us to say in answer to your comments, that we will assume that the test was thoroughly made, that the air supply was accurately measured, and that the figures given in the table are true; but we must protest against the inference which might be drawn, and which your correspondent evidently intends that your readers should draw from his figures. By an analysis of the table, we are brought for results to the last column, in which the consumption of air per inch of hole drilled is given for the "Rand" and the "Sergeant" drills respectively, under two conditions, one where the drills are mounted on columns, and the other on tripods. Now, our aggressive friends evidently desire that your readers should see very clearly that in both of these tests the "Rand" drill was bigger than the "Sergeant," and that the unthinking reader should hold up his hands in amazement that so many claims have been made for the "Sergeant," when a big "Rand" drill consumes less air per inch of hole drilled than a little "Sergeant." Is it fair to make a comparative test of the consumption of air per inch of hole drilled, between two drills, one of which has a larger diameter, hence a greater area of pressure; and a heavier piston, hence a greater momentum and force of blow than the other? On the contrary, can anyone dispute the claim that when boring hard granite boulders, a strong blow is required in order to make progress, and does anyone question the fact that a big machine will hit a harder blow than a little one? Can we not easily imagine a small drill pegging away at a hard granite boulder and consuming several hundred cubic feet of free air per minute without progressing a single inch, while a large drill of precisely the same construction would make considerable progress with an equal consumption of air. The comparison may be illustrated by a man and a boy at work driving railroad spikes. The boy may accomplish less, but will expend more breath per spike than the man.

It seems to us that the figures prove two things very clearly. In the first place, that a big drill will consume less air than a little one per inch of hole of same diameter drilled, when operating in hard material (a fact well understood heretofore). And in the second place, that a "Rand" drill takes more than twice as much air per inch drilled, when working horizontally than when working vertically or downward (due to the cushioned blow—a dis-

tinctive defect in the "Little Giant"), while with the "Sergeant" the proportion is very much more uniform. These facts furthermore prove that a test on the consumption of air per inch of hole drilled between drills of different sizes, has no practical value.

INGERSOLL ROCK DRILL CO.,
W. L. S.

The Utility of Waste Sawdust.

Owing to private reasons "Engineer" declines to answer Mr. F. D. Taylor's letter in our last issue asking for information as to where and how waste fuel is utilized in the United States.—EDITOR.

Steam Pump Practice.

NEW GLASGOW, N.S., 21st Dec., 1889.

The Editor

THE CANADIAN MINING REVIEW:

SIR,—In your November issue there appears an article under this heading, reproduced from the *American Machinist*. Such articles are no doubt interesting to your readers, but the one in question, while advancing some thoroughly practical ideas, is somewhat in error regarding the use of the so-called air chamber, which is described as a practical remedy for the evil arising from a suction pipe becoming obstructed or being too small or too long. There seems to be an erroneous idea prevalent, even among practical men, regarding the chamber now largely in use on the suction pipes of pumps. It is commonly mentioned as an *air chamber*, and the fact of it being called such, and its action described in the article in question "as an elastic cushion of air for the incoming water to come into contact with so as not to strike the returning plunger with so hard a blow," tends to confirm rather than dispel the erroneous idea.

The chamber must, correctly speaking, be a vacuum chamber, because, having a direct communication with the suction pipe, whatever be the degree of vacuum required to allow the atmospheric pressure to force the water to the pump affects all parts alike in communication with the suction pipe, and if a vacuum gauge be placed on the chamber it will be found to register the varying degrees of vacuum as the vertical lift is increased; so then the usefulness of the chamber on the suction pipe cannot be as described in this article, but exactly the reverse. It may be described as follows: Let us suppose the lift to be such as requires a vacuum of 10 lbs. to be formed before the water will rise to the pump; then 10 lbs. of the atmospheric pressure must be removed from the pump barrel, the suction pipe and the chamber on the suction pipe, and water in rising up the suction, with a velocity due to the speed of the plunger, passes the chamber and rushes into the pump barrel, where the vacuum is being formed and maintained. Then at every turn of the stroke of the plunger the formation of vacuum ceases, and the water continues its upward flow in the suction pipe to the vacuum chamber until the plunger commences its return stroke or until it destroys the vacuum which first caused it to be put in motion. The so-called "air chamber" on the suction pipe tends to keep the column of water in that pipe in motion while the plunger is turning or changing its stroke, as the air chamber *proper* on the discharge tends to keep that column of water in motion; but the action of each is as opposite as the lifting and forcing of the pump on which they are used, the pres-

sure of the air in the chamber on the discharge being in proportion to the column forced, and the vacuum in the chamber on the suction being in proportion to the weight of the column raised.

I am, &c.,
BRITON.



In General.

A piece of bad type in our last issue made the total exports of Canadian Phosphate for 1888 read 17,416 tons instead of 17,446.

Mr. James Nicholas, a well known chemist from London, is travelling in the country for the purpose of examining mining properties with a view to purchases for an English Syndicate.

Du Lievre.

One of our correspondents writes: The late mild weather has been a source of trouble to the regularity of the mining operations of our river, once more showing the desirableness of more practicable roads and means of communication between the mines and the C. P. R. line. The sudden closing of the navigation on the 21st November took the managers by surprise; the winter provisions at the mines, and the grinding stock at the mills, were somewhat incomplete in consequence. Nature's river road, which promised so well at the start, began to fail at Christmas, and on resuming work after the holidays three teams together loaded with provisions, broke through the ice at Priests' Creek, thereby destroying the road at this place. Smith's Point too has been another place where a "portage" was necessary, so that it has been impossible so far, to commence the transport of the supply of "seconds" for the mills at the Basin, and "*habitants*" and their teams are looking hungry for lack of work and provisions. We anxiously look for good ice to promote the normal activity of our river.

We learn that Messrs. Lomer, Rohr & Co. have made arrangements to utilize the grist mill at the Basin for the grinding of the second grade phosphate of that district. It is well known that the pulverization of phosphates in Europe is universally effected by horizontal French burrs, but some are inclined to suppose that our Canadian apatites are too hard to be treated in a like manner. We take exception to this opinion, remembering that several varieties of mineral phosphates, such as come from Aruba, W. I., and the Department of Lot, France, are equally hard as our average "green ore." We therefore congratulate Messrs. Lomer, Rohr & Co. in leading the way to demonstrate that good old-fashioned machinery can often hold its own against the patented complications burdened with heavy royalties, which so often give cause for regret when costly "experiments" are performed in the laboratory of industrial enterprises.

We observe that some of the "grinders" now applied to this important and ever increasing industry, give much annoyance from frequent breakages, whereby projected profits quickly transform themselves into heavy losses and disappointment to shareholders.

The Dominion Company is now erecting very complete wharves and loading facilities at their new North Star landing, where admirable arrangements are being made for the storing of ore, and their easy transport to scows by a system of car tracks from each bin. This improvement speaks well for the intelligent direction of this prosperous enterprise. We also understand that the directors are now considering the advisability of putting their own steamboat on the river to tow their scows this coming season.

The Phosphate of Lime Co. (limited) is still enjoying the benefit of its "bonanza" chamber in their old stand-by the No. eleven pit at High Rock, and the work goes on merrily. The enormous quantities of cordwood being now piled up and drawn in from the remote points of their limit, gives cause for reflection that our timber supplies will evidently play out long before our phosphate deposits. Are we to see King Coal supreme and coming to our aid, or will it be our natural water powers, captive and obedient to our will, which shall keep in movement our restless drills and derricks?

The Canadian Phosphate Co. (limited) is benefitting by the mild winter in continuing to run their Beaver-meadow car track without intermission, so that the only difficulty has been to obtain sufficient hands in order to avoid a block by too much material in the cobbing house. The present new company having completed the first year of its existence, held its general meeting in London (Eng.) this month. Several important improvements will have been discussed and disposed of at this opportunity, of which we hope to furnish the report in our next issue.

The works for the construction of the new locks at the Little Rapids have completely blocked the portage road at this point. The mining companies above the Rapids, and all interested in the winter transport on the river, have just cause to demand that an efficient portage should be immediately provided, otherwise the passage of heavy teams will be quite impracticable.

We have received from Messrs. Stewart & Spittall, Ottawa, a very favorable report by an experienced Geologist on their phosphate locations on lots 1, 2, 3, 4, 5 and 6, in the 4th range of Bowman, and lot 6 in the 10th range of Portland West, in all about 700 acres.

Perth District.

Mr. Peter McLaren has commenced work on his phosphate property on lot 4 at Otty Lake; this property was worked a few years ago and several thousand tons were taken from surface shows; preparations are now being made for deep mining on a large scale, and so far the indications of favorable results are very satisfactory. Mr. McLaren has also purchased a new phosphate property in Bedford, near Fermoy. This location was discovered about six weeks ago by T. R. Taggart, of Westport, and has good prospects of becoming one of the best productive properties in Ontario. One of the veins shows phosphate 30 feet wide on the surface. Operations on both these lots are now being pushed forward under the able superintendence of Mr. E. Watts, of Buckingham, a miner of considerable experience, in the working of phosphate locations.

The Anglo Canadian Phosphate Company are having improving results at the Otty Lake mines, some wide and persistent seams having been discovered that promise steady work for the winter. At the Bobb's Lake mines the success is regarded as phenomenal; one of the oldest Canadian phosphate miners, now at work there, states that in the region of a mile's extent there is not a space for twenty feet without a seam of phosphate, and an experienced mining engineer, who has just surveyed the property, reports that he examined 67 different veins of phosphate which had been opened since June last and out of which 99 piles of phosphate had been taken, amounting to over 700 tons, done by a force averaging less than 15 men all told. He says "he never saw anything like it;" states that in one pit the men are sinking on a seam of 5 feet wide of solid phosphate, while in a drift from the same pit they are in a bed of phosphate measuring 18 feet by 8 feet and its extent not yet known; there is not a great deal of impurity to separate and the phosphate is being placed on the pile ready for shipment at a cost of not over \$2 a ton.

Kingston District.

Mr. Jas. Foxton and Messrs. Smith and Lacy are putting out ore, and Mr. Foxton's mine is said to be looking remarkably well. Some enterprising Americans are tunnelling a hill on one of Capt. Moore's properties in Sydenham, with a view to the profitable working of phosphate veins that have been discovered higher up the hill. Capt. Moore expects to have about 400 tons from his properties by spring.



We shall be greatly obliged to mine owners and superintendents for such authentic reports of their operations as may concern shareholders and the public.

Nova Scotia.

L. E. McKam, accompanied by a Mr. Leslie, of Philadelphia, is at Springville looking over the iron properties for a syndicate of American capitalists. Mr. Leslie, who is an expert, speaks highly of the ore and thinks there is unlimited quantities of it.

The output from the Intercolonial Coal Company's mines, Westville, for the past year to 30th November, reached 152,400 tons. The sales by land and water to same date were 138,000 tons.

We learn that the New Albion Mine at Montague, known as the DeWolf gold mining property, has been sold to a New York syndicate, by Charles Annand, for the handsome price of \$60,000 in cash.

We understand the "Westfield" gold mine in Queen's County, has been purchased at a fair sum by Capt. Nicholls, for some of his English friends. It appears the property was bonded several months ago, and considerable prospecting done since on the "Jumbo" lode, which ranges from 20 to over 75 feet wide. A shaft has been sunk some 40 feet deep in one of its widest places, and the yield far exceeds anticipations. Free gold is prominent, but its chief value lies in the concentrates which are abundant. No doubt this pioneer mine on such large leads will cause much stir in the locality, and also call attention to some of the other large leads of the province.—*Critic.*

Over three quarters of a million tons of coal were shipped from Cape Breton mines last year, and the output was only limited by the ability to secure vessels to carry coal to the upper provinces.

The annual general meeting of the shareholders of the Cumberland Railway and Coal Company will be held at the Company's offices, Chesterfield Chambers, St. Alexis Street, Montreal, on Wednesday, 13th February next, at 3 30 in the afternoon. The transfer books will be closed from the second day of February, exclusive, until after the meeting.

The Coxheath copper mine, owned by the Eastern Development Company (Limited), is quietly but vigorously pushing development work with a force of 100 men. Compressors, drills and boilers to increase the Rand power drilling plant to ten drills, left New York December 28th., and will reach Sydney about January 9th. A winter's supply of dynamite has been put in store. New miner's dry house, carpenter shop, and saw mill completed, and an ore dressing house 60 feet square is in process of erection, to be heated by the exhaust steam from the boilers. Underground, the main cross-cut at the 190 foot level has been driven 221 feet south and 303 feet north of the shaft, a new ore-body has been cut 180 feet north of the 10 foot vein (vein B), which dips south towards the main vein. A working cross-cut from the shaft to vein B., from the 140 foot level, is in 30 feet, and will reach the vein about February 1st. Sinking the shaft will be resumed this week. Assay of sample ore-body in west drift of vein C, gave: Copper $14\frac{5}{100}$ per cent, and $16\frac{3}{4}$ ounces silver. Sample of fines made by crusher in running through some 300 tons of ore gives 12.4 per cent copper and 5 ounces silver. Samples of fines and clean up from hand-picking tables gave 2.88 copper and $4\frac{1}{2}$ ounces silver. Several tons of these low-grade fines have been sent to Humboldt & Co., Germany, for experimental treatment. Work on the Argyle mine, which is the western extension of Coxheath, has heretofore been confined to the surface. It is the intention to sink a prospecting shaft on the property during the winter. The company is also erecting boring apparatus on its coal property at Little River, and will put down a test hole in expectation of striking the basis of the veins which crop out vertically on the same areas. The Government railroad through Cape Breton, which is located within a third of a mile from the coal shaft and within five miles of Coxheath, is being pushed by the contractors, and will probably be running at the close of 1889, thus enabling the company to ship its outputs during winter months.

The case of Putnam v. Hurdman, now before the Supreme Court, is attracting great interest in gold mining circles. The plaintiff claims to be in partnership with the defendant in gold mining operations at Oldham under the style of "The Olham Gold Company." The case occupied four days before the jury at the October sittings of the court and was continued to allow the defendants to amend their pleadings. The present application is for the appointment of a receiver, pending the final decision of the case, an extraordinary remedy only granted in cases where co-partnership is denied, as in this case, when a fraud and misconduct are shown. The plaintiff, who resides at Exeter, N.H., in his affidavit alleges the grossest fraud and misconduct on the part of the defendants. He claims to have supplied all the money employed in the

purchase of the mining property and in the opening and development of the mines, amounting to \$15,000, and that afterwards when the mining operations had become profitable, defendants attempted by false representations and fraudulent conduct to deprive him of all participation therein and of all rights in the co-partnership. Many of the plaintiff's allegations are denied, and others explained by defendants, who have filed a voluminous affidavit in the matter. Judgment has been reserved.

Quebec.

The owners of the Lake Temiscamingue silver mine, Messrs E. Wright, Geo. Goodwin and G. P. Brophy, have made arrangements to take out ore next season. There are 4000 tons of ore now on the dump. A smelter has also been procured.

The Bristol Mining Company are erecting a new Calcining Kiln at their mines, and expect to have it completed in about two weeks. If this kiln works satisfactorily it is the intention of the Company to erect several more. The Branch Railway connecting the mines with the Pontiac Pacific Junction Railway is ready for the ties which are contracted for. The steel rails will be imported by the first steamer to the St. Lawrence in the Spring.

At the annual meeting of the Lake Huron Silver and Copper Mining Company held at Montreal the following officers were elected: Messrs Thos. Wilcox, president; Strachan Bethune, vice-president; Alexander Mitchell, R. M. Esdaile and Lorn S. MacDougall, directors; F. W. Barlow, secretary-treasurer.

The mines of the Excelsior Copper Company at Harvey Hill are working full time with about 120 men in all. The shafts are reported to be developing splendidly, and the veins are becoming wider and richer as work proceeds. The company is shipping now the high grade ore to Vivian & Sons, Swansea, and the low grade ores are going to New York. From 4 to 5 car loads of ore leave the mines per week. The company will put up a large quantity of machinery on the property, and it is expected that it will give employment to between 500 and 1000 men before July. The mines are doing as well as could possibly be expected.

Ontario.

A report from St. Catharines says that while drilling on the experimental gas well on John H. Broderick's farm, a short distance west of that city, a pocket of natural gas was struck at a depth of 312 feet. The find caused a sensation. The vein will be immediately piped, but the drillers have decided to bore deeper as they feel confident a large flow will be found.

The Imperial Oil Company of Petrolea, who operate with a capital stock of \$500,000, have a very extensive and complete plant that includes over forty-six acres of land at Petrolea and over ten acres at London. They have their own wells, their own steam cooperage, where they make their own barrels, and are owners of machinery for the manufacture of patent tin cans; thus placing this company in position to place the products they manufacture into barrels or patent tin cans made by themselves, insuring uniformity of the oils, and also of what is of great importance, good, sound, uniform and regular packages of every kind.

The Sarnia Oil Company, Sarnia, Ont., has been incorporated with a capital stock of \$250,000.

The gas well at Thorold, Ont., is now emitting about 60,000 cubic feet of gas per day.

Boring operations for natural gas will be begun in a few days at a point about a mile from Ottawa.

Sudbury District.

Last month we reproduced from the *Engineering and Mining Journal* of New York some particulars regarding the management of the Canadian Copper Co.'s mines, which a late dispatch from our correspondent states to be in some particulars incorrect. Capt. Andrews is not general superintendent as stated, but is simply mining captain, and is governed entirely by Dr. E. D. Peters, jr., the able metallurgist and manager of these well equipped mines. Captain Jones, who has been with the company from the first, is superintendent of underground workings, and his thorough knowledge of this work is evidenced by the very systematic manner (all by contract) with which operations under him are carried on. It is safe to say, that without Captain Jones, the workings of the company would not have been so far advanced as they are to day. Mr. J. D. Evans, civil engineer, (also connected with the Central Ontario Railway) has had charge of the erection of the immense trestles and smelter building, as well as the laying out and putting through of the different branches of railways from each mine to smelter. Mr. John Grigg is master mechanic, and Mr. F. L. Sperry late of Yale College, is chemist and assayer. Mr. MacArthur, from Montana, is in charge of the smelting branch, and on him in large measure depends the success of this important work. This energetic officer is constantly at the works, both day and night, looking after the feeding and tapping of the ore, and lately, your correspondent is informed, he has been on his feet throughout five nights without sleep. Under his superintendence the smelting is conducted very economically. Smelting operations are carried on day and night, the ore being hauled from each mine daily by a standard gauge engine and cars belonging to the company. The roasting of the ore has turned out a decided success.

Another correspondent writes:—The Canadian Copper Co. is very nearly ready to make a start with their smelting, and the interested public look anxiously forward to see how great a success Dr. Peters will make of the treatment of these enormous deposits of copper and nickel ores. The Sudbury plant is merely preparatory, and as the ore is easily smelted, and is self fluxing, the work to be done there is comparatively simple. After a cupula smelting of these mixed ores, the resulting matter, containing 30 to 35 per cent. of the mixed metals, will for the present be shipped elsewhere for treatment, whether to Swansea or to some part of the States the management do not tell us, but it must be handled by those familiar with the separation of copper and nickel, a process for which Dr. Peters has invented and patented. About twenty piles of ore are burning on the temporary ground. These are in various stages, from thirty to ninety days of burning. They will probably average 350 or 400 tons per pile. New piles are being built on a carefully prepared permanent burning ground, over which a tramway runs from the dressing floors. This trestle is

about half a mile long, with a maximum height of about twenty-five feet, and runs over the roasting piles into the cupula shed above the level of the charging floors, where it discharges ore, fuel, etc., into bins. The cupula is in place, and fixtures on the spot. The several mines are turning out considerably over one hundred tons per day, but this does not represent their capacity; the addition of a few more miners would easily double the production, as there is ample room to accommodate an extra force mining in good ore. The present force is about 250 men, comprising miners, smelters, construction men and labourers.

The workings at the Vermillion Mining Co. are completely shut down and left in charge of a brother of A. G. Duncan. Very recently Ranger, Stobie & Tough have sold out their stock to wealthy influential parties, so that with new blood we may look for an intelligent resumption of operations, which will doubtless prove this property one of sterling worth.

Your correspondent has before mentioned the brothers Simpson, of Cranston, Ill. One or both of them has spent most of the time since May 1st in Graham Township, (lots 10 and 12, Con 2) and on these two lots have opened shafts on five different veins. These shafts are 10 feet deep on a 14 inch vein; 10 feet deep on a 30 inch vein; 25 feet on a 33 inch vein; 17 feet on a vein of 42 inches on the surface, widening to seven feet, and eight and a-half feet on a small vein of four inches. This latter is the most recent discovery. Attention was attracted to it by a show of free gold on the surface. At a depth of four feet a sample was taken of the fines made by blasting, and it yielded \$460 to the ton, with some little silver. The vein is clear quartz with copper and iron pyrites. On the 33 inch vein a 7 x 7 foot shaft is sunk. At 15 feet they struck another vein one foot wide increasing to 16 inches. Your correspondent has found \$220 in gold from one sample from this property.

Port Arthur District.

Mining operations are in a very satisfactory and progressive state, owing partly to the excellent state of the roads in the silver region, the extraordinary richness of the ore at present being produced, and likewise to the various mining companies who have already purchased outright or secured options on the most promising properties in the market. Some of the activity, especially in iron, is doubtless due to the recommendations which the Royal Commission on Ontario's mineral resources, are likely to make to the Legislature at the opening of Parliament this month. There is every reason to believe, that the commissioners will suggest that large tracts should not be locked up by mere speculators, but that a certain amount of development per acre per annum shall take place. It is also possible that an increased price will be placed on the valuable lands taken up for mining purposes.

The Badger mine still keeps the lead in the production of bonanza ore. It is almost impossible to over estimate the capabilities of this mine. It is an almost every day occurrence to see ore from this mine going several thousand dollars to the ton and not selected specimens by any means. The stamp mill will probably be in operation in a few weeks to operate in the low grade ore.

The Beaver Mine superintendent has been on a visit to his directors, and it is now announced

that Governor Alger and General Hecker have purchased Mr. Peters interest in that property, and consequently have the whole control. Sufficient headway having been made in ore output, the roar of the stamp mill will again resound through the comparatively silent valley and hills.

The Elgin Mine, controlled by the same company still continues to develop satisfactory, and four English companies having bonded the Porcupine, Beaver West, Silver Creek and Big Bear properties in the same range of hills it is more than likely that no less than seven mines within a radius of three miles or so will be making things lively before spring in that vicinity.

The Silver Mountain Mines, both East and West are presently doing remarkably well. The rich strike in the East at the 380 foot level still continues, and a new shaft is now being sunk as fast as the drills and air compressors will admit, within 250 feet of their West limit. They are likewise going down steadily with No. 3 shaft where the vein is 13 feet in width.

The Wolverine and Silver Fox Mines further to the west are still in their infancy, but getting along nicely; the latter somewhat under a cloud owing to a lawsuit *re.* a title to part of the claim.

Iron lands to the north and west of the latter, as well as at the Kaministiquia station, near Port Arthur, are being explored and taken up rapidly.

Several mining properties have changed hands at a considerable advance, in anticipation of railway facilities.

During the last few months mining in this section has received a great impetus, and the more recent reports describe veins of nearly pure silver, too rich to stamp with the ordinary machinery, and almost too massive to blast out, yielding in some instances as much as 24,000 oz to a ton of ore. This has caused considerable excitement at Port Arthur. One mine alone is making a daily output of \$30,000, or about £160,000 a month. This property is among the pioneers, while numerous others shew very large returns from ore running as high as \$1,000 to \$30,000 to the ton. The Americans are foremost in the field, owning pretty well all the mines now working. Capitalists are flocking into the country, new mines are being opened up, others are about to be developed, and new trails and roads constructed, while everything points to a veritable silver boom.—*Financial, News London.*

Rat Portage District.

It may not be generally known that among the properties whose titles are in dispute is the famous Sultana Island, ores from the gold mine of which have recently furnished such rich assays. The Dominion title to this land is held by Mr. Ham. G. McMicken and his associates in his mining business; but there is another claimant to this property, in the person of Mrs. Snow, daughter of Mr. R. Gerrie, of Winnipeg, who holds the Ontario title to four hundred acres of the island, including the mine.

Manitoba and North-West Territories.

The Manitoba Oil Company, operating in the Lake Dauphin district, has suspended operations after reaching a point 743 feet below the surface. After penetrating the limestone the drillers struck a second strata of salt, and below this a

red sandstone. The salt strata "caved," and the sand pump was lost in the "cave." The soft red sandstone was penetrated 200 feet, and it was then feared that without casing the sand pump would work across the well and stick the tools, and consequently work was suspended until casing could be procured. The American oil men who had charge of the work returned home, but the company will resume operations in the spring.

Notice is given that application will be made to the Parliament of the Dominion of Canada, at its next session, for an Act to incorporate the Saskatchewan Railway and Mining Company, with powers to lay out, construct and operate a double or single line of railway with steel rails from a point at or near Dunmore Station, on the Canadian Pacific Railway, thence northerly to a crossing at the South Saskatchewan River, at or near Downing Ford, thence across the Red Deer River near its mouth, thence by the best route to a crossing on the South Saskatchewan River at or near Saskatoon, thence in a generally north-easterly direction to Fort La Corne and a junction with the Hudson's Bay Railway or to a point on the Nelson River, with power to the said Company to vary its line a distance of twenty-five miles to the north or south of the said course, and with power to acquire, sell and work coal and other mines, and that said Act shall contain all necessary clauses for the purchase of lands, the acceptance of bonuses in land or money, or securities for money, the building of bridges, and wharves, the navigation of adjacent rivers or lakes, the construction, lease, purchase or charter of steam or other vessels for the purpose of transport of their traffic on the said navigable waters, the construction and equipment of telegraph or telephone lines, or both in connection with the railway, the erection of stations and the making of traffic or other arrangements with other railway companies, and all other usual clauses and privileges necessary for a company with such objects and purposes.

British Columbia.

Despatches from San Francisco state that Messrs. Dunsmuir & Sons, of the Wellington Collieries, have made a reduction of \$4 in the price of coal to dealers there. It is expected that this will cause a similar reduction all round.

It gives us pleasure to state that the Canadian Anthracite Coal Co. resumed operations on the 26th ult., upon an extensive scale at their mines at Banff. Mr. Winwood is the mining engineer in charge; Mr. A. Pugh, general manager; and Messrs. Ramsay and Reese, mining contractors. At present 150 men are employed. Chinese labor is employed to advantage on the breaker, and in picking coal, but none are permitted to work in the pits. Up to date, but one cargo has gone west, but we are informed that it is the intention of the company to increase the output to 500 tons per day very soon. A very satisfactory arrangement has been made with the C. P. R. as to freight.

34,393 tons of coal were shipped from Nanaimo for month ended 31st December last, as follows:—

R. Dunsmuir & Sons,.....	11,110	Tons
East Wellington Company.....	3,209	"
Vancouver Coal Company.....	20,074	"

Total shipments for December..... 34,393 "

1,050 tons of iron ore were shipped from the same port during December, ex steamer Fern-dale.

Following is the coal output for the year 1888; a very satisfactory increase:

	Tons.
R. Dunsmuir and Sons.....	200,000
Vancouver Coal Co.....	259,432
East Wellington.....	35,809
Total.....	495,241
Output of 1887.....	410,573
Increase.....	84,668

Mr. Robert Scott, for many years an overman of the Wellington Collieries, has been awarded the contract for sinking a shaft for the Vancouver Coal Company, on what is known as the Company's North Field, and contiguous to the Wellington Colliery property. Mr Scott severs his connection with the Wellington Collieries at the beginning of the year and in about ten days time will commence the sinking of the new shaft. It is expected that the coal will be reached in about 250 feet from the surface—*Nanaimo Free Press*.

The No. 6 Shaft of the Wellington Collieries is now down to a depth of 170 feet. It is expected that the coal will be reached at a depth of 250 feet. The shaft is therefore about half way down to the coal.

The miners at the Wellington Collieries decided, at a meeting held on 2nd instant, that unless the men engaged in getting out pillars received an increase in their present rate of pay they would go out on strike. The mines were consequently shut down. At time of writing we have not heard whether any arrangement has been come to.

The following figures will show the output of coal from the Wellington collieries for the past fifteen years:—1874, 81,000 tons; 1875, 110,000 tons; 1876, 139,000 tons; 1877, 154,000 tons; 1878, 171,000 tons; 1879, 241,000 tons; 1880, 268,000 tons; 1881, 228,000 tons; 1882, 282,000 tons; 1883, 213,000 tons; 1884, 394,070 tons; 1885, 365,000 tons; 1886, 326,636 tons; 1887, 413,360 tons; 1888, 487,784 tons. It will thus be seen that the output from these mines was not only far in excess of any previous year, but that 74,424 more tons of coal were taken out than in 1887.

Commenting upon the strike at the Wellington collieries the *Nanaimo Free Press* of 11th says: The situation at Wellington during the past 36 hours has assumed somewhat alarming proportions and it now appears as if the present attempts of an amicable settlement would end in a failure. The miners at their meeting yesterday afternoon refused flatly to accede to Mr. Dunsmuir's propositions as reported by the committee who interviewed him on Wednesday last in Victoria. This is certainly an unfortunate state of affairs and it is to be deplored by all parties as "strikes" and "lock-outs" are not only detrimental to the miners and the mine owners but it affects all classes in the city and district, and already its deleterious influence is beginning to be felt. Nor is that the only bad aspect of affairs for this morning comes the news from Victoria that Mr. Dunsmuir has instructed Mr. Bryden, Superintendent of the mines, to serve the miners with an order to vacate the company's houses, nor will they be paid for last month's work un-

til they conform to the general rule of removing their tools from the mines and deliver them to the store-keeper.

The following are the shipments of gold from this province for the past year as reported by Messrs. Garesche Green & Co.:—

1888.	Bank of British Columbia.	Bank British North America	Garesche, Green & Co.
January.....	\$ 5,580 44	\$ 580 00	\$ 2,100 00
February.....	12,346 80	2,521 60	1,983 90
March.....	9,445 35	.....	4,930 00
April.....	20,712 43	1,880 00	5,487 00
May.....	18,117 35	2,215 00	6,393 00
June.....	26,841 53	5,616 88	10,445 00
July.....	29,771 53	4,158 00	13,045 00
August.....	29,500 13	5,950 00	18,308 88
September.....	41,019 03	6,644 80	15,305 04
October.....	35,230 55	4,619 00	15,949 00
November.....	36,292 93	13,419 00	25,813 00
December.....	22,564 98	3,960 00	13,695 00
Total.....	\$287,423 05	\$51,564 28	\$ 133,454 82

RECAPITULATION.

Bank of British Columbia.....	\$287,423 05
Bank of British North America.....	51,564 28
Garesche, Green & Co.....	133,454 82

Total for 1888.....	\$472,442 15
Total for 1887.....	578,924 52

Decrease.....\$106,482 37

From the above it will be seen that the export by the banks has fallen short by a considerable amount. It is not owing to a decreased output, for Cariboo furnishes a somewhat larger sum than in 1887, and reports from other sections are said to be equally good. The apparent deficiency is rather thought to have been caused by the shipment of gold by other channels than those which have heretofore monopolized the field.

The Petroleum Fields of Ontario.

ROBERT BELL, B. A., S.C., M. D., L.L.D.

(Continued from December Issue.)

The drift clay of Petrolia is so impervious that tanks excavated in it and lined with wood are found to be capable of holding the oil, and large quantities of it are stored in this way. These receptacles are circular in plan, and the largest are forty feet in diameter by fifty and sixty in depth, but those of the average size are thirty feet in width by thirty five feet in depth. They have a total capacity of 600,000 barrels. The largest of them are owned by tanking companies. On November 1st, 1886, ten of them were full, and Mr. W. K. Gibson informed the writer that the aggregate of oil which they then contained was 415,000 barrels. The same gentleman gave me the following as the stocks of oil on hand on December 31st, 1885: in tanks at the wells, 36,000 barrels; in the tanking company's tanks, 373,504 barrels; crude oil and its equivalent at the several refineries, 38,372 barrels, or a total of 447,876 barrels. At 85½ cents per barrel in the tanks, which was the actual mean rate at which crude oil was sold during 1885, this would represent \$382,934. The average selling price of the illuminating oil in 1886 was 14½ cents per gallon. Formerly the crude oil was sent to London (Ontario), Sarnia, Montreal, and elsewhere, to be refined, but now the whole of it, except about 5 per cent., is treated at Petrolia, in nine distilleries and refineries. The stills are great elongated cylinders, the largest

of them capable of holding from 275 to 300 barrels of petroleum. The six stills at the Producers Works, when in operation contain 1,600 barrels, or 266 each. These are arranged side by side, to the number of six to twelve or more, on a brick "bench," so that the fire can reach their whole length beneath. The fuel consists of water and the refuse tar, strongly injected together from a nozzle. Mr. James Kerr, who is thoroughly versed in the chemistry of petroleum, and acts as inspector for the refiners, gave me the average commercial constituents, per cent., of the crude oil of Petrolia, as follows:—

Naptha	7.72
Burning oil of the Government standard	49.50
Gas oil	14.74
Lubricating or paraffin oil	9.65
Intermediate oil	4.00
Paraffin wax	1.41
Hard coke	3.75
Soft coke and waste	9.23
Total	100.00

During 1886, the average number of pumping engines at work in the district was 75, or one to every 35 wells. They had an average of 18, and a total of 1,350 horse-power. About 30 engines, with an average of 15, or a total of 450 horse-power, were employed in drilling. In addition to these, the refineries, shops, lumber-mills, etc., connected with the oil industry, employed about 50 more engines, with an average of 40 and a total of 2,000 horse-power, to say nothing of the locomotive power required on the railways, etc., to transport the products. Large numbers of horses are used in hauling the crude and refined oil, the machinery, lumber, and supplies of all kinds required in the business. The total number of men and boys employed in connection with the oil industry of Enniskillen is about 2,000, and these would represent a population of about 10,000 dependant upon it. The town of Petrolia and its suburbs contain about 6,000 inhabitants. Besides the above, about 200 more men and boys are employed in connection with the refining, etc., of the crude petroleum sent elsewhere; and in a less direct manner, the products of the Ontario oil-field help to swell the general volume of the carrying and other trades of the country. It would be difficult to give a correct estimate of the capital employed in the business, but it must amount to several millions of dollars. The wages of experienced well-borers and distillers are \$1.50 to \$2.00 per day, while labouring men receive from \$1.25 to \$1.50. All the operations are carried on by native Canadians, who have, by their own ingenuity, developed each branch of the business to its present perfection, by carefully studying the necessities of the case. This has afforded an excellent mechanical education to a large number of intelligent men, whose services are now sought for in every oil-producing country in the world. We hear of them directing the boring, pumping, storing, and other operations connected with the petroleum business in Galicia, Russia, Afghanistan, Belochistan, India, Burmah, California, Australia, etc., where their skill and knowledge are highly appreciated.

Excelsior Copper Company.

The first ordinary general meeting of this company was held on Monday, 10th December, at the Cannon Street Hotel, Colonel Malleon, C.S.I., presiding.

Mr. Geo. Roe Fenwick (the secretary) having read the notice convening the meeting,

The Chairman said that since the formation of the company the board had determined to send out Colonel Gay to the mine to extend and develop it. At the same time they ordered the amount of machinery necessary to turn out 100 tons per day. Colonel Gay arrived on November 12th, and he had sent home reports of a highly satisfactory character. He stated that the mine was in excellent order, and although the machinery at his disposal was comparatively imperfect, he had been able to ship consignments of ore regularly. The company had received on the first shipment 33 tons of ore, on the second shipment 40 tons, and on the third shipment 56 tons. It was not, he thought, an unsatisfactory feature, as indicating the appearance of the mine, that the tonnage had advanced on each shipment. They had gone from 33 to 56 tons, and Colonel Gay's letters encouraged the board to hope that future shipments of ore, when the improved machinery was put up, would be of much larger tonnage. (Hear, hear.) In every way the reports from the mine were therefore satisfactory, especially when it was borne in mind that at present it was only the debris left by former miners that was being worked. The company had about 30 tons of ore lanked, which was being sent rapidly to the station. All the letters received from Colonel Gay were of the same character, and if there was one feature in which they differed, it was that each succeeding letter gave a more promising account of the mine than its predecessor. (Hear, hear.) It appeared that the lodes were extremely well defined, and the quality of the ore excellent. Messrs. Vivian & Son, who received the first shipment of ore, wrote to-day: "Concerning ours of Saturday, we have just received a telegram from our Swansea friends, advising us that the reason they have not been able to send account sales for the ore, as expected, is that they have been unable to obtain reference assays which they were having made as a check on their own. These have been made this morning, and are as follows:—12 bags, 31½ per cent. of copper; 45 bags, 49 per cent. of copper; 46 bags, 12¾ per cent.; 22 bags, 13½ per cent.; 240 bags, 14½ per cent.; 32 bags, 51¾ per cent.; 55 bags, 31¾ per cent.; 90 bags, 40¼ per cent.; sweepings from the above, 18¼ per cent." Considering the ore shipped home was the debris or mixed with the debris left by previous miners, the return was very satisfactory. (Hear, hear.) In a short time the company would be obtaining richer ore, and he had no doubt that it would be received in England in the quantities mentioned in the prospectus. He would be happy to answer any questions that shareholders might think fit to ask.

Mr. Simpson asked what proportion of the £50,000 had been subscribed, and as to the machinery sent out.

The Chairman said that the company went to allotment on £15,000, that being sufficient, according to estimate, to provide the necessary machinery to make returns, and shareholders would agree that no time had been lost in making those returns. (Hear, hear.) The value of those already made was some £3,000 or £4,000. With regard to the machinery, £500 worth had been sent out in the first place, and finally £1,000 worth. The board had sent out exactly what was requisite according to estimate.

Mr. Simpson further inquired whether the board were corresponding with the mine manager each week.

The Chairman said that up to the present time they had received letters always once a week, and sometimes twice, in addition to cablegrams. A cablegram to hand that morning stated that a further consignment had been despatched, and that another would follow on Wednesday. (Hear, hear.)

Mr. Simpson asked if he might assume from that that almost daily shipments were being made.

The Chairman said that they were being made, if not daily, at all events twice a week. In fact it was impossible for the mine to present a more satisfactory aspect than it now did. It had begun to give returns at once, and those returns were increasing weekly. (Hear, hear.)

This terminated the business of the ordinary meeting, and an extraordinary meeting was convened.

The Chairman said that the company had been formed under Table A, and while that table gave certain powers to the directors, those powers were too indefinite, and it had been deemed advisable to draw up a fresh code of the constitution of the company, which would give the directors definite powers to act without coming to the shareholders for every detail. (Hear, hear.) Copies of the new articles had been sent to the shareholders, and he proposed that they be substituted for those now existing.

Mr. T. H. Scarborough seconded the resolution, which was unanimously carried.

This terminated the formal business of the meeting, and

The Chairman said that the board were so satisfied with the character of the letters received from Colonel Gay, that they were open to the inspection of any shareholder. It was impossible for any member of the company to read those letters without sharing in the enthusiasm with which they evidently were written. (Hear, hear.) Colonel Gay had seen the mine before he was connected with the company, and was so impressed with its value that he had staked his whole future on its success. He had given up a very lucrative business in England to go out and manage the mine, and had put what money he could spare into it. Those were facts which spoke volumes. (Hear, hear.)

A shareholder asked if Colonel Gay had had any previous experience of mining.

The Chairman said he believed that Colonel Gay had been formerly engaged in mining in California.

Mr. Simpson proposed a vote of thanks to the chairman, which was unanimously carried.

The Chairman, in acknowledging the vote, said that the interest of the directors was that of the shareholders, and he felt that, judging from the successful commencement under Colonel Gay's auspices, the company would achieve a very great success indeed.

Quartz Mining in British Columbia.

If placer mining is on the decline, or rather stationary, it is not so with quartz mining. The signs of the times are that this Province will soon hear the hammer of many stamps pounding out the precious metal, and see the glare of the furnaces smelting the base from the pure. In all sections of the province the miner and prospector have been at work, and many known claims have been developed sufficiently to show that they will repay practical working, while the number of gold, silver, galena and copper deposits which have been brought to light for the first time, will mount up into the hundreds. In Lillooet, Nicola, Okanagan, Rock Creek, Cherry Creek, and other districts, and especially in the large district of Kootenay a great amount of practical work has been accomplished.

The country bordering on Kootenay Lake has been shown to possess gold, silver, copper and carbonate deposits of amazing richness, and several carloads of ore, which were shipped with difficulty and enormous expense to Helena and Butte smelters, have returned handsome sums to the hardy and enterprising shippers. Enough has been done during the year just passed to show that in the Kootenay region there are mineral deposits which bid fair to rival in richness the mines which have made Virginia City, Nevada, famous. Hundreds of men are now in the region, and it is assured that many thousands will visit it during the present year. Capitalists have also travelled the rough trails to inspect the mines, and it is gratifying to know that several have made investments, and will open up the mines acquired. There is also good reason to believe that the Ainsworth & Co's charter for a railway connecting Kootenay Lake and Columbia River will be carried to completion by the C.P.R. The Manitoba road, which is pushing westward from Helena, is also likely to pass within a few miles of the British Columbia boundary, and this will furnish cheap and easy access to and from the mines, and of shipment of ores to smelters at Helena and Butte.

The mines at Field have already begun the shipment of ore to the smelter at Vancouver, and the silver and copper mines of Jubilee Mountain are being opened up as quickly as the means of locaters will permit. In many other sections of Eastern and Southern Kootenay quartz has been paid considerable attention to, and the prospects are bright indeed for rapid advancement towards the production of bullion.

At Illicillewaet, in the Selkirk range, also in the Kootenay district, this year the work has been altogether confined to the opening out of the silver mines located there. The Selkirk Mining Co. have run in several tunnels at various levels, and have determined a permanent vein of ore averaging over \$100 per ton. The Corbin & Kennedy claims have been further opened up and are developing to the thorough satisfaction of their owners. A road is being built by the government up the north fork of the river, and when this is completed it will enable the cheap carriage of ores to the railway track.

At Stump Lake, in the Nicola district, the Nicola Mining Co., composed of English capitalists, have carried on considerable work in developing their mines. Several shafts have been sunk to a depth of two hundred feet, and cross-cuts run at the fifty and one hundred foot levels. The shafts are to be sunk to a depth of three hundred feet. A tunnel has also been run in on one of the ledges, tapping it at a depth of one hundred feet. The ledges are from two to three feet in width, and the ore, which is of a paying character from the surface, improves in quality as depth is attained. As soon as the company is thoroughly satisfied with their permanency and value, the ledges owned by them will be worked on an extensive scale. Other mines in the neighborhood have been worked, one company shipping a quantity of concentrates to San Francisco. However, the means

A new Ottawa enterprise.—Before many days are over we shall have in full operation at Ottawa a first class Lapidary Establishment. The upper flat over the Automatic Refrigerator Company's store on Wellington street has been secured and is now being fitted up with the most improved machinery for lapidary work of every description. This is a step in the right direction, and the promoters of the enterprise hope to meet with the support of our manufacturing jewellers, who are now entirely dependent on the foreign market for material. As they are not, as a rule, mineralogists, and therefore easily deceived in a gem by being guided by its color, this difficulty may now be obviated by dealing with the Ottawa Company, who are mineralogists, and every stone cut by them and named may be relied upon. All kinds of gems will be cut; also slotting and polishing of every variety of stone.

employed to save them were on such a limited scale that there was no profit in the transaction. There is no question, though, that if worked on a business basis the mines would return a fair profit. They are adjacent to wood and water in large quantity, situated in a country where a wagon can be driven to any of the mines, and within reasonable distance of the C. P. R., which company will likely build a branch line into the district if mining is proceeded with on a large scale.

At Rock Creek the permanency and richness of the ledges there have been fully established, and one company at least will proceed with the work of reducing the ore to concentrates. It is partly free milling. A carbonate deposit also exists near the gold leads, and ore is now being shipped from this to a smelter. A new discovery was made twenty-five miles from Rock Creek, near Okanagan Lake, of gold, silver and copper deposits, which give promise of being good properties.

In Lillooet district a large amount of prospecting work has been done, and several claims are being opened up with good prospects. Several extensive ledges of free milling ore were located during the summer, and these will be thoroughly investigated during the present year. One on Anderson Lake, exposed on the steep side of a mountain, is especially promising, being rich in gold and readily worked.

In Cariboo district, and especially in the neighborhood of Barkerville, a good deal of attention has been bestowed upon the quartz ledges. One small stamp mill was erected, and is now working free gold ore in Black Jack Gulch. A test smelting works, erected by the government, is just completed. It has been built for the purpose of treating ore in quantity from the mines which are being opened out in order to determine their quality. The disadvantages of being nearly three hundred miles from a railway line has prevented the shipping of ore, and it is expected that the government works will fill a want long felt. They have not been erected for commercial purposes, but simply to aid in the development of the innumerable ledges which exist in the hills surrounding the famous Williams creek and its tributaries, and which are known to be rich in mineral. The treatment of a number of tons of ore from any ledge will, it is thought, prove whether it is worthy of extensive development. This determined, capitalists will be induced to turn their attention to Cariboo, which has sent out so many millions of dollars from its placer mines. It is, with good reason, believed that the quartz ledges will, in the near future, produce greater wealth in bullion than ever was taken from the alluvial deposits.

On Vancouver and Queen Charlotte Islands, in the Archipelago and along the coast, ledges containing gold, silver and copper have been slightly developed, but there has been so far no great discovery. Ledges containing rich deposits of mineral are believed to exist, but the luxuriant vegetation prevents their easy discovery. Time and the elements and fortunate accident may yet unearth mines that will prove of astounding richness.

Altogether the outlook of the quartz industry is very cheering, and before 1889 has sped it is confidently hoped that bullion in no mean quantity will have been produced. British Columbia possesses the mineral. All that is needed is capital, and even that, somewhat tardily, it is true, is coming to us.—*Colonist*.

The Port Arthur Mines.

(Manitoba Free Press.)

The Silver Mountain group comprises a number of veins situated about the eastern extremity of Jack Fish Lake, in the Township of Lybster, and along by White Fish River, the principal vein in this group being Silver Mountain vein itself, on which work has been going on for some years. It is worked at both the east and west end, known as Silver Mountain East and Silver Mountain West, the locations being a mile apart. It is a strong vein throughout, but yielding far larger returns to the west end company than to the east. Both mines are well equipped with machinery, and a good road constructed by the Government leads to Murillo Station, twenty-five miles distant. While the west end mine is turning out the best ore, it cannot be expected that the east end, owing to its position, will long undervalue it. This mine is contracted by an English company. In the Beaver and Badger group the veins number about a dozen, all lying within a radius of about three or four miles. Four of these—the Badger, Porcupine, Silver Creek and Little Pig—are located within a mile and a half stretch of country along the west bank of Silver Creek, at the foot of a bluff or trap-covered ridge. The first mentioned of these, the Badger, is at present a bonanza mine. It has only been in operation for one year, but in that time has yielded big returns to its company. It is controlled by an American company, as indeed most of these mines seem to be. Heretofore the development has been going on very slowly, the Company, chiefly a directorate of merchants, being very cautious, but an increase in men and machinery has lately been made, and the mine is now assuming a

business-like air more in accordance with its yielding capacity. Some sixty or seventy men are employed, while the whole location number about one hundred people. During the past summer the clearing has been largely extended, and now a clear plot of two hundred acres in the forest stretches from the head of the vein to Silver Creek. A number of substantial log houses have been put up, a supply store and a stamp mill awaiting its machinery, a large part of which is already on the ground. Sinking has been carried on pretty steadily here, and they are now about one hundred and fifty feet from grass. The silver ore was struck, when the vein left the trap overflow, ten feet of which covered the slates here, and it has continued wonderfully rich to the present time, when it now looks as if the Bonanza had reached its end. However, this is still a mere speculation and it remains to be seen what further blasting will bring to light. The vein continues a good width, being three feet or more in places and though the pay streak has diminished to three or four inches, further sinking may show the rich zone still strong. Drifting has been quite extensively carried on also, three levels or galleries having been driven some distance east-west of the shaft, the two upper levels being air levels, or drifts, as technically called, opening into day at the east side, the slope of the valley. Steam twisting gear has been put in, and forty or fifty car-loads or more can easily be lifted to the bank in ten hours. The main rock is then trammed from the upper level out to the rock house; the slate which is picked out underground is also hoisted and dumped along the trestle. The pay ore, when it has reached the rock house, is carefully picked over, being first washed with hot water carried in pipes from the boiler, so that the silver may be readily detected. Two classes of ore are made; the first class, known as smelting ore, is carefully cobbled and graded into three grades, the first grade assaying from fifteen hundred upward to ten thousand dollars per ton; the second averaging three or four hundred to nine hundred dollars; while the third class is made up of ore carrying Galena i. e. lead, and which the smelters prefer in a separate lot for the convenience of reduction. The rich ore is then disposed of, while the balance, known as mill-rock, a stamp-rock constituting the lean or hungry portions of the vein, and assaying from fifteen to a hundred dollars or more per ton, is trammed to the mill to be there crushed, concentrated and amalgamated. It is no exaggeration whatever to say that wonderfully rich ore has been taken out of this mine. Nuggets of black sulphide of silver, weighing from one to six pounds, I have myself handled, and are knit through and through with fine wires of native silver, so that the "gangue," or accompanying rock, could scarcely be discerned is not at all uncommon. The rich ore is then assayed, great care being taken that the sample will fairly represent the average yield of the vein, barrelled and shipped to the States to be smelted. One shipment of forty barrels was recently made which yielded a return of nearly forty thousand dollars, and at the time of my leaving another shipment was in readiness. The smelting ore so far yielded by this mine is alone sufficient to wipe out expenses and pay a very respectable dividend to the shareholders. It is proposed to put the mill in running order in the spring, when the three or four hundred tons of stamp-rock already on the dumps will be disposed of at the rate of ten or twelve tons per day. This mill will not be the customary stamp crusher, viz.: a set of five, ten or twenty stamps, but one large sized stamp working in a mortar, which will be open all round the bottom to allow for the passage of the crushed ore. This contrivance, I was given to understand, is quite a recent innovation in milling machinery, but from the satisfactory accounts given of one already in operation in the Calumet and Hecla mines of the South Shore, it is to be presumed that this will work equally well. In this mine, as yet, there has been no occasion for artificial ventilation, since the air levels form a draught with the shaft acting as a flue, a strong current of wholesome air is kept continually circulating. So far as timber is concerned the poplar wood answers for house building, while a saw mill at the Beaver mine, a mile and a half distant, furnishes lumber; but a difficulty to be overcome in the mining engineering is the lack of pine or tamarack timber of sufficient girth and strength for stopping purposes and timbering the shaft, much of the larger timber having to be carried several miles. At present a large gang of men are employed underground, working alternating shifts of eight hours each; but as development proceeds, I am informed that their force will be largely increased.

Adjoining the Badger property lies the Porcupine mine, which was at one time in full blast, as a large clearing, some shanties and a shaft-house indicate, but, owing to financial difficulties, at present it is shut down. The vein is two or three feet wide at the surface, and though I had no opportunity of going underground, the levels being closed and the shaft full of water, the stamp rock on the dumps looks very promising. The man in charge of the location showed me some of the best ore which

had been stacked in the shanty close by, and it can safely be said this vein will prove, when fully developed, one of the best mines in this district. A company, composed of Canadians, and headquarters in Port Arthur, I believe, is about to begin operations on this mine very soon. It has two veins a little to the north of these, the Silver Creek, and Little Pig, which have been tested by trial-pits and proved satisfactory, and only await the necessary capital to begin sinking. This last mentioned is an unusually strong vein, and one on which, owing to its position along the side of a bluff, a stone-throw from the Government road, would be easily mined.

The Beaver mine, already famous among silver mines, I had the opportunity of spending a week at, seeing both its surface and underground equipment. This mine is an excellent instance of what an enterprising mining company may do in this region. It is now three years since this mine was opened up, and it has worked unceasingly since that time. The mine at first yielded a big bonanza, which naturally played out, but sinking was continued till rich ore came again in sight. Now that it has experienced some of the difficulties to be contended with in this region it has developed into a settled organization—working, yielding and paying. It has changed management and mining captains several times, but this has not for a moment impeded the work. At one time this mine employed two hundred men. Its machinery is of the best, and its mechanical appliances throughout, both on surface and under ground, good. There is a large mill with a capacity of 30 tons per day on this location, but at present it is inactive. I am informed, however, that crushing is to begin in the spring, sufficient stamp-rock being at present on the dumps to keep it constantly at work crushing for three years. This vein intersects a mountain, in some respects making it easily mined. While, however, there was plenty of opportunity to run air-levels, and thus make easy ingress and exit for the men, it necessitated sinking the shaft in the summit, while all the hoisting plant had to be placed at the foot of the mountain. This required a thousand feet of cable to run up the mountain side and on to the shaft-house to lower and raise the "cage," but all has been successfully accomplished, and the mine works with thorough system day and night. The inflow of water, a difficulty so often met with in mining, has not been a serious one to contend with here, nor has it been to any extent so in any of these mines. They are three hundred and fifty feet from "grass" in this mine, have driven five levels, three of which are air levels, i. e., opening into day, and are at present sinking the shaft or drifting on the sixth level. While richer zones than the one they are at present working in have been passed through, it is not impossible, in fact it is quite probable, that a bonanza streak may be again encountered. As it is, however, the ore coming out is of excellent quality, showing in liberal quantities both sulphide of silver and the metal itself. This mine is fully equipped with air drills controlled by a powerful compressor. The wages here, as in the other mines, run from one dollar and a half to three dollars per day. The miners employed in these mines are of all nationalities, a large number of Cornishmen, who are capital miners, being employed as well as Swedes, Finlanders and Italians. These latter, however, I am informed, are objected to sometimes by the other workmen on the ground that they are willing to work for less money. This should not, however, deteriorate their services in the eyes of their employers. Drinking has been forbidden on these locations, but this does not prevent an occasional spree at Port Arthur or the Half-way House, which indiscretion, however, seems to be occasionally allowable in miners the world over. When in full working order a location presents the appearance of a small village, with its dwellings, boarding-houses, general store, butcher shop and school. Indeed, it may be called an incorporated community, having, in place of a reeve and councillors, a manager, with his sub, the mining captain, controlling underground work, the master mechanic, assayer, etc., at whose beck and nod the regulations and funds are doled out. It was during my stay at this mine that I took the opportunity of visiting the Rabbit Mountain Mine, located about three miles to the southeast, and reached by a trail through the woods. This location discovered by an Indian some five or six years since lies in a hollow between two trap bluffs which almost exclude the light of day, and in winter I have heard that the sun only shows himself for two hours during the day. A group of shanties lies about the shaft along with a mill and a hotel, the latter bearing the pretentious name of the Windsor House. It was through the proprietor's kindness that I was furnished with most of my information concerning this mine. No work is going on here at present; a full supply of mining and mill machinery, all set up, stands silent, and the shaft, some two or three hundred feet deep, is full of water. This vein showed an unusual width on the surface, and continued wide and regular throughout the sinking, being when abandoned seven feet in width. The rock, however, I am informed, was good average mill rock, but a sudden decrease in assay returns shook the faith of the St. Paul Co. and it was dropped. The plant, a most ex-

cellent one, consisting of engines, compressor, with a capacity of nine drills, first-class pumps and a full mill plant of five stamps, vanners, and concentrators, and sufficient room to increase the crushing power to ten stamps if needful, stands waiting for an energetic company to oil up with sufficient grit and capital. About a mile distant from this mine lies the Caribou and Big Bear locations, both promising mines, I am informed, and on both of which sinking has been carried on to some extent. As regards the third group of mines situated at the margin of Lake Superior, I am not prepared to make any definite statements. The Jarvis Id. mine, under the management of an English company, has been shut down, but that the character of the ore fully warranted it I do not know. From personal observations I have concluded that this region must eventually take a prominent part among silver mining regions. My reasons for so believing are these: First, the nearly universal excellence of the ore—while much is rich, it is all good average stamp-rock; second, the close proximity of the ten or twelve veins in the middle group (all within a radius of three or four miles) leads one to believe this belt has plenty of outcrops still awaiting the prospector's pick; third, as the depth increases the value of the ore does not necessarily decrease, as the richest ore is in zones or "pockets," liable at any moment to come into view; fourth, it is as yet a new mining region, and but awaits the thorough and satisfactory trial of one or two mines to ensure the success of all; fifth, the geological indications are favorable—the veins are all north-west and south-east, being true fissures. I have already mentioned the difficulties to be overcome so far as I know. What seems to be needful are companies, comprised in part at least of mining men, with sufficient capital to push the work when threatened with a decrease in returns.

The Treatment of Ores.

NOTES ON THE SELECTION OF A PROCESS.

I.—Free Gold Milling.

(Mining Journal.)

The difficulties attending the selection of the best process of ore treatment being dependent in most cases upon local circumstances, and upon the intricate and complicated composition of the ores, it is not possible to lay down exact rules covering all cases; but the following notes will serve to indicate the principles of the processes most commonly followed, and will furnish a guide for general application.

Free gold milling is essentially applied to ores containing gold in the free state; but as a preliminary process it is commonly employed on ores in which the gold exists, partly combined with pyrites of copper or iron, the free gold being first extracted and the auriferous residue subsequently treated by a more suitable process. The successful treatment of ores containing gold in the semi-free state necessitates, however, such extremely fine crushing that in many cases it would be more economical to adopt a smelting process at once instead of passing the ore through a preliminary process. Gold milling is of all the most simple method of gold extraction, but its application is limited to the treatment of ores containing gold wholly or partly in the free state, and is not suitable for the extraction of the precious metal when chemically combined with the other metals of the ore.

In free milling the ore is first crushed wet under stamps or rolls, and in cases where the gold is disseminated in fine particles the ore is afterwards pulverised. The pulp is then passed over copper plates whose surface is quicksilvered, the gold attaching itself to the quicksilver in the form of amalgam, which is collected at intervals and retorted. The process is not only the most simple but is by far the cheapest, ores containing not more than \$2, or under 2 dwts. of gold per ton, having in well arranged mills and under favorable circumstances, just paid the cost of treatment, and in the Black Hills ore yielding \$6 or less than 8 dwts. per ton (calculating the value of retorted gold at 75s. per ounce) can be

worked to a profit, including the cost of mining as well as of milling. This, however, would not be an absolute guide as to cost, the minimum cost of working this process being of course, contingent on local circumstances such as cheap water power and labor. The adaptability of this process can be easily and expeditiously tested by panning down a finely crushed sample, when the gold, if free, will be at once made visible, and after concentration may be amalgamated with mercury and distilled out. In most cases, however, auriferous ores contain other metals generally in the form of sulphides, principally those of iron and copper, rarely of lead or zinc, and occasionally various tellurides, notably those of silver with small quantities of gold such as sylvanite and hessite, and of lead, as altaite and nagyagite. The presence of these metals renders necessary a modified method of treatment. In the first place the sulphurets must be concentrated and rendered clean from the gangue of the ore. This may be roughly done by passing the finely crushed ore over blankets or hides, collecting at intervals the deposited sulphurets, but it is a crude and imperfect method entailing much loss in the form of fine mineral carried away by the necessarily strong stream of water, and imperfect separation by reason of portions of the gangue being mechanically arrested in the crevices of the blankets or hides. The minimum gold contents in sulphurets ores that will pay to extract by subsequent methods, such as chlorination or smelting, and leave a margin to cover the cost of these operations and of the concentration, will depend in almost an exclusive degree on the perfection of the dressing machinery employed. It is quite impossible to lay down any rule which would be a guide in this respect. It is quite evident that no one machine can be adopted to the numerous classes of ore of distinct physical properties; for instance, the ore may contain minerals of nearly the same specific gravity as the gangue; again, the precious metals may be contained in minerals of varying densities; and again such minerals may be of different hardness and cannot be pulverised to any equal degree, which is one essential condition to satisfactory concentration.

The most suitable method of treating the freed sulphurets will depend mainly on local circumstances. Where the concentrates are rich and the cost of transport not heavy, it becomes a question whether it would not pay best to send the ore direct to the smelting works, for such ores—auriferous sulphurets—always command high prices on account of their co-agency as a flux (after calcination) in the treatment of other ores of the precious metal. In California the concentrated sulphurets are chlorinated (after roasting) by exposure to chlorine gas whereby the gold (rendered free by the roasting) is converted into a soluble chloride, and afterwards precipitated. The cost varies in this district from 30s. to 40s. per ton of concentrated ore, but this cost is, perhaps, exceptionally low, and would be little guide for other districts where the expense of labour, fuel, and chemicals may be higher. In such case the better mode of treatment would be by roasting and amalgamating or smelting, the latter especially when the auriferous ore contains copper, or where lead ores are available, in either of which two metals the gold may be concentrated with but little loss. This process cannot well be used on ores rich in silver. In such cases the silver is best extracted by the Mexican "Patio" process, the "Augustin" process, the "Ziervogel" process, or the "Pakra" pro-

cess, in all of which the silver is converted into a chloride by the agency of common salt, and afterwards dissolved out. A detailed description of each may be found in any good work on the metallurgy of the precious metals.

(To be continued.)

Mine "Booming" Extraordinary.

(MINING JOURNAL.)

America, as we all know, is the land of "big things," and there should be no doubt in the mind of its admirers as to the ability of its inhabitants to "lick creation" in any direction the genius of its people may suggest. If our cousins claim this as an universally applied truism, we should hesitate to allow the contention, but in mining matters we will not contest the claim. In this direction they have fairly outdone themselves in 'cuteness. In what way, our readers will not take long to discover from the *expose* of the Arkansas mining frauds which has been recently made in American papers. The story of this remarkable mining boom, which commenced in 1885 and was told in American papers at the time, will profitably bear repetition. For some years past there appears to have circulated amongst the good people of Arkansas a legend that the country was immensely rich in mineral wealth, that this wealth had once been drawn on by its former inhabitants, the Spaniards, who, on their ceding the country to France, managed to obliterate every trace of their mining exploits. The belief in this absurd story appears to have been pretty generally held, for it was carried down to the present day. In particular, the story seems to have received most credence in its relation to a certain mine called the Louisiana, which was the envy of the mining world when in the hands of its discoverers, the Spaniards, which is more than can be said of it to-day. The subsequent discovery of this old mine would be more remarkable than the legend itself, were it not that to be sceptical on the one would imply disbelief in the other.

Its history is this: Some thirty years ago, an adventuresome band of proselytes to the legendary faith, who appear to have had more confidence, than either brains or money, commenced a campaign of exploration to discover this abandoned, and concealed mine, but they soon gave up the task although it was believed at the time and subsequently that they were "on the track." However cupidity came to the rescue of incredulity once more, and the legend was again revived in its most attractive form. Whether through faith in the legend, or using it merely to work on the credulity of others, a new band of adventurers determined to seek for the Eldorado of the Spaniards, and soon gave out to the world that they had found it. A company, called the Lost Louisiana Company, was at once incorporated under the laws of the State, with a modest capital of 1,000,000/., out of which the adventurers pocketed 600,000/.? The excitement which followed this supposed discovery was immense, and the country became a huge mining camp. "Every unfamiliar rock (says the State geologist) was regarded as a valuable ore, or as an 'indication' of something." Within three years the total capital stock of new companies incorporated in the State amounted to \$111,000,000. Most of these companies, however, turned out such miserable failures that State intervention was sought, and the State geologist called upon to furnish a report on the mines. After describing the origin and progress of this remarkable boom, the report goes on to state:

"The authors of this excitement have persuaded people, whether honestly or fraudulently makes but little difference, that the ores of this region are 'peculiar,' and only required some new process to get gold and silver out of them. This delusion has been kept alive by assayers, some of whom were perhaps sincere, but some of them certainly fraudulent."

So persistently was this theory advocated that it became a question of life or death to the mining industry of the State—at least, so far as the precious metals were concerned—and in order to test the contention, a trial of the Lost Louisiana ore was carried out in the public sampling rooms of the St. Louis Sampling and Testing company, the operations being conducted under the watchful eyes of two officers of the company, Messrs H. A. Wheeler and Arthur Thacher, who were to be enlightened as to the proper method of obtaining gold and silver from this "peculiar" ore. And enlightened they were! The Arkansas assayers were Mr. A. M. Beam and "Professor" Aughey. Altogether 19 assays were made from samples taken from 46 lbs. of the Lost Louisiana ore. In two cases gold was found to the extent of 8 and 11 6-10 ozs. respectively, and the remaining tests showed only traces. But the funny part of the *expose* which followed is this—that Mr. Thacher has certified that Prof. Aughey omitted to put in the ore when the first result was obtained, and Mr. H. A. Wheeler has certified that the second result was obtained from a sample composed of a mixture of iron ore, litharge, soda, coal and charcoal, which had been purposely substituted for the roasted Lost Louisiana ore! We give full copies of these interesting documents:

St. Louis, Mo., May 1, 1888.

This is to certify that I, A. M. Beam, have been experimenting for the past three days on a certain lot of ore from the Lost Louisiana mine, Bear Mountain mining district, Montgomery County, Arkansas, by the herein below given formulas. After making ten assays with these formulas I have been unable to obtain more than a trace of gold. Every facility was offered for the execution of this work.

Crucible Assay: One-half A.T. ore, one-half A.T. borax glass, one A.T. baking soda, one A.T. test lead, five millegrams silver foil, salt cover. Melt to fusion, and add one-half A.T. test lead. When in quiet fusion take out of furnace, scorify and cupel.

Gives best results: One-half A.T. ore (roasted as before), one-half A.T. litharge, one-half A.T. soda, one-tenth A.T. argol, one-tenth A.T. nitrate of ammonia, one-twentieth A.T. chloride of barium. Salt cover. Melt to fusion, and add one-half A.T. test lead, and treat as before. When melted down stir in each case. These are the formulas I have successfully used in Arkansas, and got fifty (\$50) per ton.

(Witnessed.) A. M. BEAM.

St. Louis, Mo., May 4, 1888.

This is to certify that we, Samuel Aughey and A. M. Beam, on May 2nd, 1888, made three assays of the "Lost Louisiana" ore, Bear Mountain mining district, Montgomery County, Arkansas, and got only a trace of gold. On May 3rd, 1883, we made two assays of the aforesaid sample and got a trace of gold in No. 1, and eight ounces of gold per ton in No. 2. On May 4th, 1888, we made four assays of the aforesaid sample and obtained traces of gold in the first three assays, and got eleven and six-tenths (11 6/10) ounces of gold per ton on the fourth assay. We got the result of 8 ounces per ton in assay No. 2, May 3rd, by the follow-

ing formula "A": $\frac{1}{4}$ A. E. ore; 1 A. T. soda; $\frac{1}{2}$ A. T. litharge; 1 gram ammonia nitrate; 1 gram barium chloride; $2\frac{1}{2}$ grams argol; 10 grams potassium cyanide; 5 grams borax; 14 millegrams silver; salt cover; $\frac{1}{2}$ A. T. test lead. We got the result of 11 6 ounces gold per ton of assay No. 4, May 4, 1888, by the following formula:—"B": one-half A. T. ore; $\frac{1}{2}$ A. T. soda; $\frac{1}{2}$ A. T. litharge; 3 grams argol; 1 gram ammonia nitrate; 1 gram barium chloride; 10 grams potassium chloride; 5 grams borax; 10 9 millegrams silver; $\frac{1}{2}$ A. T. lead.

These results we obtained entirely by our own determinations, and they are satisfactory to us. Every facility was afforded us for making these assays. (Signed)

SAMUEL AUGHEY.

(Witnessed.)

A. M. BEAM.

St. Louis, Mo., May 4, 1888.

I hereby certify that I, Arthur Thacher, was present on May 3, 1888, while Prof. Aughey weighed out charge No. 2, and that he omitted to put in the ore.

(Signed) ARTHUR THACHER.

(Witnessed.)

St. Louis, May 4, 1888.

I hereby certify that I, H. A. Wheeler, on May 4, 1888, after Prof. Aughey had roasted his ore charge, *changed it for a mixture of iron ore, litharge, soda, coal and charcoal, and I hereby certify that all four assays executed by Prof. Aughey on May 4, 1888, were made from this mixture.* That these materials did not contain more than a trace of gold is proved by the result of Prof. Aughey's first three assays.

(Signed) H. A. WHEELER.

(Witnessed.)

The words in italics have been so rendered by ourselves. Against these, to say the least, very suspicious results and which the State Geologist has no hesitation in attributing to "salting," the company promoters, according to the report of the State Geologist from which we quote, produce and set-off the certificates of some of the most eminent assayers in the States, but they fail to produce any proof that the samples from which satisfactory results have been obtained by such responsible assayers, came actually from the localities they are represented to have come from, and such assayers themselves disclaim, through the State Geologist, any responsibility beyond the chemical accuracy of their tests.

In the interest of legitimate mining it is an unbounded pity that such gigantic frauds are not exposed earlier. They do incalculable mischief to the industry far and near, and it will be many years before their prejudicial effect on the development of the really good claims in Arkansas, of which there are many in coal, iron, manganese, antimony, and possibly zinc, will have passed away.

If any indirect good result from this exposure, it should act as a warning to the allurements of legendary mining, and should serve at the same time to dispel the misapprehension among many people about the value of specimens or samples in determining the value of mining properties. Assayers do not undertake to vouch for anything beyond the accuracy of their tests, and, however conscientious the owners of valuable but undeveloped property may be, it is quite impossible to obtain samples which may be relied on to represent with absolute accuracy the future turnout of the mine. Yet it is unquestionable that hundreds of mining companies are floated on no other recommendation than that of an assay made on samples which can give but

the slightest evidence of the value of the bulk of the workable mineral. If the Arkansas frauds do no other good than to draw attention to this, there will be some compensation and consolation to legitimate mining. The honorable profession of assaying, in the keeping of honest men, should not suffer, but rather be the more respected, by this exposure.

The Largest Flume in the World.—

The flume that conveys the water from the mountains to the reservoir at San Diego, Cal., is 25 miles long, and is made of redwood. In the course of the flume there are 315 trestles, the longest of which is 1700 feet long and 85 feet high. This is the Los Cochinos trestle. The Sweetwater trestle is 1200 feet long and 85 feet high. The main timbers used in these trestles are 10 by 10 and 8 by 8. They are put together on the ground, and raised to their positions by horse-power. There are eight tunnels in the course of the flume, the longest of which is 2,100 feet in length. The tunnels are 6 by 6 in size, with a curved roof. Each mile of the flume required on an average 250,000 feet of timber for its construction, and the redwood used in the box is all 2 inches thick. The San Diego flume is said to be the largest yet constructed.



SEALED tenders addressed to the undersigned and endorsed "Tender for Hot Water Heating Apparatus, Coaticook, P.Q." will be received until Monday, 4th proximo, for the construction of a Hot Water Heating Apparatus at the Coaticook, P.Q., Post Office Building.

Plans and specifications can be seen and form of tender and all necessary information obtained at this Department and at the Clerk of Works Office, Coaticook, P.Q., after Monday, 21st instant.

Persons tendering are notified that tenders will not be considered unless made on the printed form supplied, and signed with their actual signatures.

Each tender must be accompanied by an accepted bank cheque made payable to the order of the Honorable the Minister of Public Works, equal to five per cent of the amount of the tender, which will be forfeited if the party decline to enter into a contract when called upon to do so, or if he fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department will not be bound to accept the lowest or any tender.

By order,

A. GOBEIL,

Secretary.

Department of Public Works, }
Ottawa, January 18th, 1889. }



SEALED TENDERS addressed to the undersigned and endorsed "Tender for Hot Water Heating Apparatus, Aylmer, P.Q." will be received until Monday, 21st instant, for the construction of a Hot Water Heating Apparatus at the Aylmer, P.Q., Post Office Building.

Plans and specifications can be seen and form of tender and all necessary information obtained at this Department and at the Office of the Clerk of Works, Aylmer Post Office Building, on and after Monday, 7th instant.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied and signed with their actual signatures.

Each tenderer must be accompanied by an accepted bank cheque made payable to the order of the Honorable the Minister of Public Works, equal to five per cent of the amount of the tender, which will be forfeited if the party decline to enter into a contract when called upon to do so, or if he fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department will not be bound to accept the lowest or any tender.

By order,

A. GOBEIL,

Secretary.

Department of Public Works, }
Ottawa, January 5th, 1889. }

W. T. MASON.

T. J. JONES.

MASON & JONES,

BOOK AND GENERAL JOB PRINTERS

(CITIZEN JOB DEPARTMENT),

48 & 50 QUEEN ST., - - - OTTAWA.

88, 90, 92, 94 Rideau, 15 to 23 Mosgrove
and 186 Sparks Sts.

S. & H. BORBRIDGE,

Manufacturers of

Saddles, Harness, Trunks, Valises, Bags,
Satchels, Horse-Blankets, Beef and Oil-
Tanned Moccasins.

OTTAWA.

By Royal



Letters Patent.

The Perfection Smoke Consumer & Fuel Economizer.

FOR ALL HORIZONTAL BOILERS, STATIONARY AND MARINE.

At City Waterworks (Wheelhouse), C.P.R. Works and Canadian Rubber Co., Montreal

Users of Lancashire, Cornish, and other flued boilers, invited to correspond.
Improved method of setting for new and existing boilers.

Dobson & Brodie, - - - 169 St. James St.,

MONTREAL.



—FOR—

Mines, Elevators, Inclines, &c.

GALVANIZED GUY ROPE. BRIDGE CABLES.
HAWSER ROPES.

WIRE of all inds. Insulated WIRES

John A. Roebling's Sons Co.

117 & 119 LIBERTY St., NEW YORK.

H. L. SHIPPY Sec'y.

VALUABLE PLUMBAGO

AND OTHER

Mineral Lands FOR SALE,

IN THE TOWNSHIP OF BUCK-
INGHAM, COUNTY OF
OTTAWA.

1st.—Lot 28, in the 6th range, containing
100 acres, in addition to the salina of the lake.

2nd.—North half of lot 23, in the 5th range,
containing 100 acres.

3rd.—Nine acres of lot No. 28, in the 5th
range, with water privileges thereto appertain-
ing, being site of mill dam, etc., etc.

The property formerly belonged to the Mon-
treal Plumbago Mining Company, and was
worked successfully for several years, until the
company's mill was destroyed by fire, but the
mill dam remains almost uninjured, and there
are on the property several houses, sheds, etc.,
built for various purposes when mining opera-
tions were carried out.

The Plumbago Deposits

upon the property are regarded as amongst the
richest and most extensive in the Dominion.
As to the quality of the Plumbago, it has been
extensively used in the manufacture of crucibles,
lubricating leads, stove polish, etc., etc., and
given unbounded satisfaction. This is estab-
lished by the experience of consumers, and by a
certificate from the celebrated Battersea Cruci-
ble Works, London, England, a copy of which
is open for inspection.

MICA

has also been discovered in quantity

The lands are in the Phosphate region, and
recent prospecting has disclosed a rich and
extensive deposit of this mineral. There are
unrivalled facilities for transporting the ore to
and from the mines by the Ottawa River and
C. P. Railway. Distance from mines to Railway
Station 6 miles. Good road.

All that is required to make these valu-
able mines handsomely remunerative is a little
capital and enterprise.

The Title is Indisputable.

For information apply to

WM. H. DICKSON,
160 Waller St., Ottawa.

H. E. DICKSON,
Russell House, Ottawa.

OR TO THE OFFICE OF

THE CANADIAN MINING REVIEW
OTTAWA.



DEPARTMENT OF Inland Revenue.

An Act Respecting Agricultural Fertilizers.

The public is hereby notified that the provisions of the Act respecting AGRICULTURAL FERTILIZERS came into force on the 1st of January, 1886 and that all Fertilizers sold thereafter require to be sold subject to the conditions and restrictions therein contained—the main features of which are as follows:

The expression "fertilizer" means and includes all fertilizers which are sold at more than TEN DOLLARS per ton, and which contains ammonia, or its equivalent of nitrogen, or phosphoric acid.

Every manufacturer or importer of fertilizers for sale, shall, in the course of the month of January in each year, and before offering the same fertilizer for sale, transmit to the Minister of Inland Revenue, carriage paid, a sealed glass jar, containing at least two pounds of the fertilizer manufactured or imported by him, with the certificate of analysis of the same, together with an affidavit setting forth that each jar contains a

fair average sample of the fertilizer manufactured or imported by him; and such sample shall be preserved by the Minister of Inland Revenue for the purpose of comparison with any sample of fertilizer which is obtained in the course of the twelve months then next ensuing from such manufacturer or importer, or collected under the provisions of the Adulteration Act, or is transmitted to the chief analyst for analysis.

If the fertilizer is put up in packages, every such package intended for sale or distribution within Canada shall have the manufacturer's certificate of analysis placed upon or securely attached to each package by the manufacturer; if the fertilizer is in bags, it shall be distinctly stamped or printed upon each bag; if it is in barrels, it shall be either branded, stamped or printed upon the head of each barrel or distinctly printed upon good paper and securely pasted upon the head of each barrel, or upon a tag securely attached to the head of each barrel; if it is in bulk, the manufacturer's certificate shall be produced and a copy given to each purchaser.

No fertilizer shall be sold or offered or exposed for sale unless a certificate of analysis and sample of the same shall have been transmitted to the Minister of Inland Revenue and the provisions of the foregoing sub-section have been complied with.

Every person who sells or offers or exposes for sale any fertilizer, in respect of which the provisions of this Act have not been complied with—or who permits a certificate of analysis to be attached to any package, bag or barrel of such fertilizer, or to be produced to the inspectors to accompany the bill of inspection of such inspector, stating that the fertilizer contains a larger percentage of the constituents mentioned in sub-section No. 11 of the Act than is contained therein—or who sells, offers or exposes for sale

any fertilizer purporting to have been inspected, and which does not contain the percentage of constituents mentioned in the next preceding section—or who sells or offers or exposes for sale any fertilizer which does not contain the percentage of constituents mentioned in the manufacturer's certificate accompanying the same, shall be liable in each case to a penalty not exceeding fifty dollars for the first offence, and for each subsequent offence to a penalty not exceeding one hundred dollars. Provided always that deficiency of one per centum of the ammonia, or its equivalent of nitrogen, or of the phosphoric acid, claimed to be contained, shall not be considered as evidence of fraudulent intent.

The Act passed in the forty-seventh year of Her Majesty's reign, chaptered thirty-seven and entitled, "*An Act to prevent fraud in the manufacture and sale of agricultural fertilizers*," is by this Act repealed, except in regard to any offence committed against it or any prosecution or other act commenced and not concluded or completed, and any payment of money due in respect of any provision thereof.

A copy of the Act may be obtained upon application to the Department of Inland Revenue, as well as a copy of a Bulletin which it is proposed to issue in April, 1888, concerning the fertilizers

E. MIALL,
Commissioner.

January, 1889.

WANTED.

SPECIAL NEWS CORRESPONDENTS to represent leading English and American papers. Previous experience not absolutely necessary. Address, with stamp, European-American Press Association, No. 7 Upton St., BOSTON, MASS, U.S.A.



THE Intercolonial Railway OF CANADA.

The Royal Mail Passenger & Freight
Route between Canada and
Great Britain,

—AND—

Direct route between the West and all points on the Lower St. Lawrence and Baie des Chaleurs, also New Brunswick, Nova Scotia, Prince Edward Island, Cape Breton and Newfoundland.

New and Elegant Buffet Sleeping and Day Car on through Express Trains.

Passengers for Great Britain or the Continent, by leaving Toronto by 8 00 A.M. train Thursday will join Outward Mail Steamer at Halifax Saturday.

Superior Elevator, Warehouse and Dock accommodation at Halifax for shipment of grain and general merchandise.

Years of experience have proved the Intercolonial, in connection with steamship lines to and from London, Liverpool and Glasgow to Halifax, to be the quickest freight route between Canada and Great Britain.

Information as to Passenger and Freight rates can be had on application to

E. KING,
27 Sparks Street,
OTTAWA.

G. W. ROBINSON,
Eastern Passenger Freight Agent,
137½ St. James St., MONTREAL.

D. POTTINGER,
Chief Superintendent.

Railway Offices, Moncton, N.B.
Nov. 20th, 1888.

The Polson Iron Works Co'y TORONTO, ONT.

Manufacturers of the Celebrated "Brown
Automatic Engine."

GENERAL DEALERS IN

MINING MACHINERY.

SPECIAL AGENTS FOR

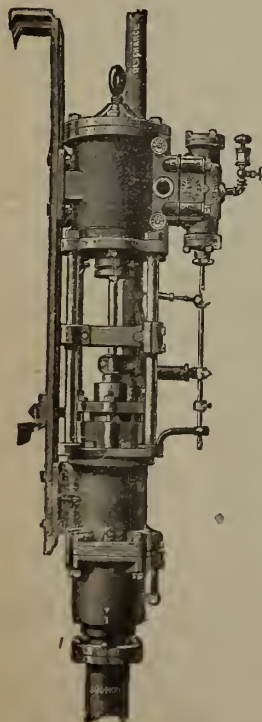
Knowles' Steam Pumps,

B. T. Sturtevant's Blowers and Fans,

Burleigh Rock Drills.

Hoisting Engines and Boilers, Quartz Mills, Diamond Prospecting Drills, Rock Breakers.

Office and Works, Esplanade E.; Warehouse, 38 Yonge St., - + TORONTO.

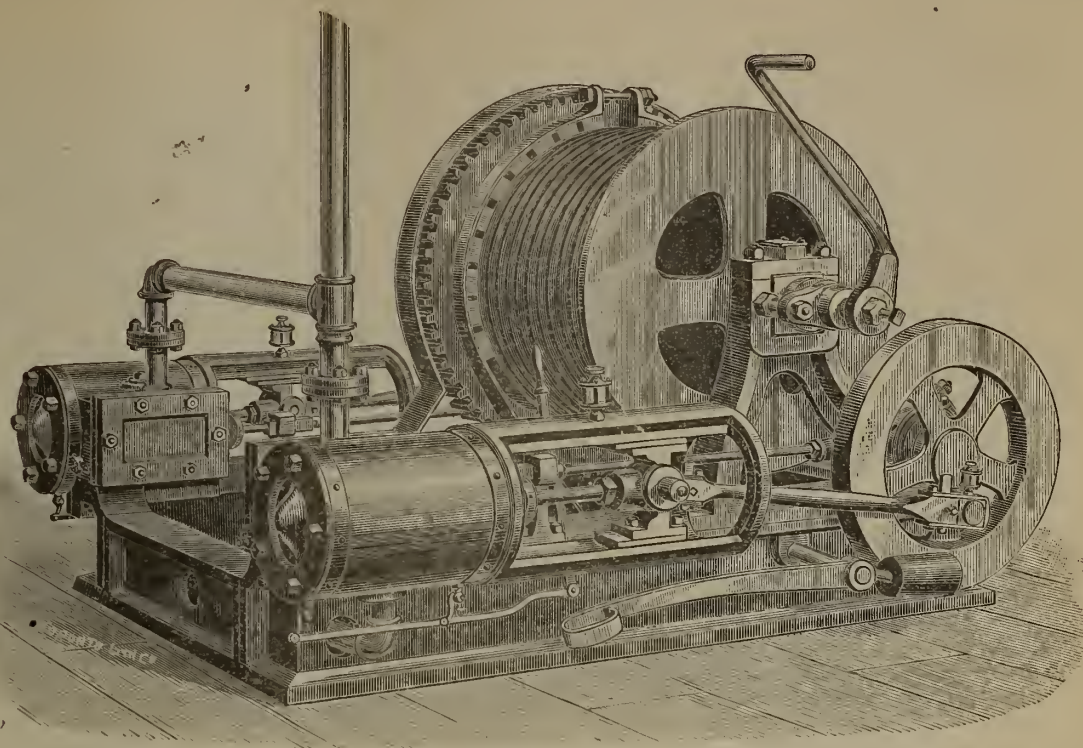


JOHN DOTY ENGINE CO.

Toronto, Ont.

MANUFACTURERS OF

Mining & General
Machinery.



HOISTING ENGINES

—: FOR :—

Mines,
Coal Docks,
Elevators,
Bridge Builders,
Contractors, &c.



CORLISS ENGINES

Tug & Steam Yacht Engines,
Mill Engines.

Shafting & Mill
Gearing.

All Descriptions of Boiler
and Tank Work.

Send for Estimates and
Catalogues.

RUSSELL & CO.

PROVINCIAL AND DOMINION
LAND SURVEYORS,
CIVIL AND MINING ENGINEERS,
PORT ARTHUR, ONTARIO.

Mining Properties Surveyed, Reported on and Dealt in.

Latest and Most Complete Plans of Thunder Bay
Mining District Always on Hand.

A. L. RUSSELL, A. H. MACDOUGLL, W. W. RUSSELL.
P. L. S., D. L. S. P. L. S., D. L. S. M.E.A.MCAN.SOC.C.E.

FOR SALE. Asbestos Mines.

On Lots 27, 28 and 29, in Range A, of Colrairie,
Megantic County, P. Q.

300 ACRES,

One Mile from Quebec Central Railway.
Free from Reserves or Royalties.

James Reed,
Reedsdale, Megantic, P. Q.



MONEY ORDERS.

MONEY ORDERS may be obtained at any
Money Order Office in Canada, payable in
the Dominion; also in the United States, the United
Kingdom, France, Germany, Italy, Belgium,
Switzerland, Sweden, Norway, Denmark, the
Netherlands, India, the Australian Colonies, and
other countries and British Colonies generally.

On Money Orders payable within Canada the
commission is as follows:

If not exceeding \$4.....	20c.
Over \$4, not exceeding \$10.....	50c.
" 10, " " ".....	10c.
" 20, " " ".....	20c.
" 40, " " ".....	30c.
" 60, " " ".....	40c.
" 80, " " ".....	50c.

On Money Orders payable abroad the commis-
sion is:

If not exceeding \$10.....	10c.
Over \$10, not exceeding \$20.....	20c.
" 20, " " ".....	30c.
" 30, " " ".....	40c.
" 40, " " ".....	50c.

For further information see OFFICIAL POSTAL
GUIDE.

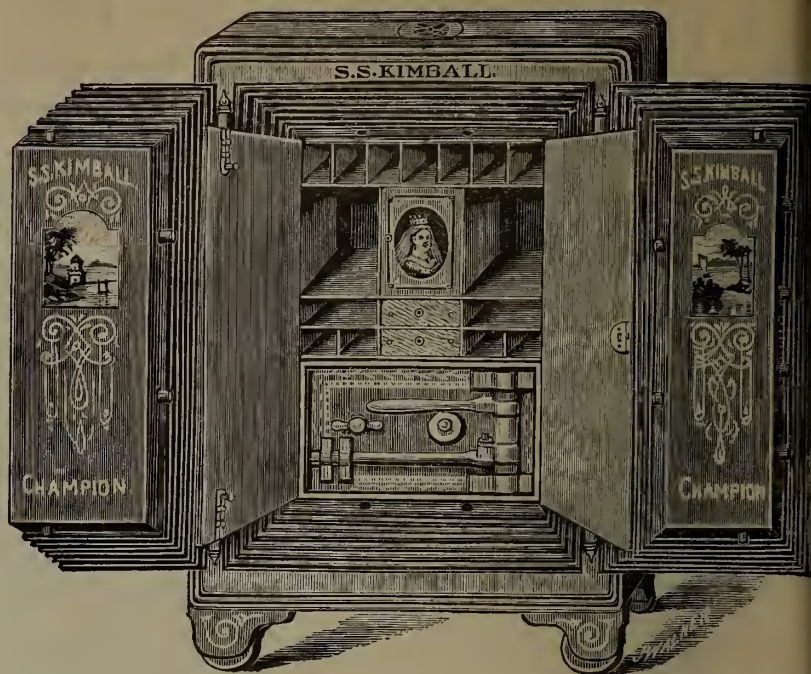
Post Office Department, Ottawa.
15th Sept., 1888.

Champion Fire and Burglarproof Safes.

These Safes have the best record of any in the Dominion. Price 30
per cent. cheaper than any other first-class Safe.

SEND FOR CATALOGUE AND PRICE-LIST.

S. S. KIMBALL,
577 Craig St., Montreal.



Van Duzen Steam Jet Pump.

MINING.—Our \$16 Pump preferred to a \$200 Steam Pump.

STATE OF MAINE ASSAY OFFICE,
F. L. BARTLETT,
PORTLAND, ME., June 21, 1883.

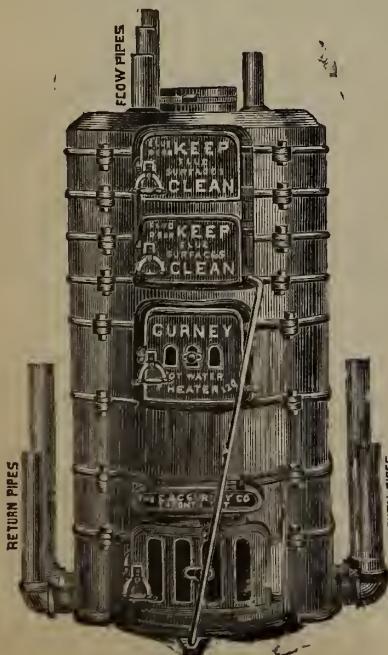


"GENTLEMEN,—The No. 5 'L' (\$16) Steam Jet Pump I purchased of you I have
used for raising water from a mining shaft fifty feet deep. I set it to draught twelve and force
thirty eight feet. It worked very well indeed, although I was obliged to carry steam 150 feet
from the boilers and in weather often below zero. I carried 75 pounds of steam at the boiler,
and the Jet Pump took the place of a No. 3 K (\$200 Piston Pump), that I had to remove.

"Yours truly, F. L. BARTLETT."

Address for further particulars,

CARTH & CO.,
MONTREAL



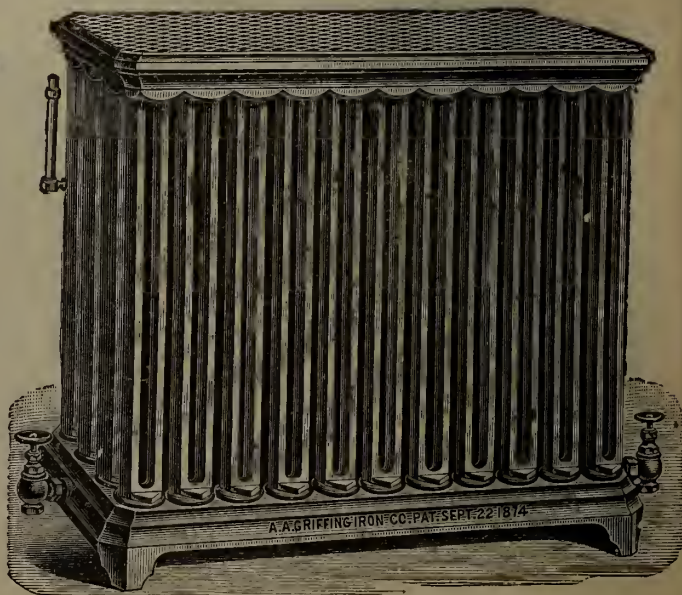
USE GURNEY'S IMPROVED CELEBRATED Hot Water Heaters!

Guaranteed more Economical than any other
Heater now made, and containing every
known Improvement in Hot
Water Heating.

STEAM FITTINGS, CAST IRON PIPE,
REGISTER, GRATES, ETC.

HOT AIR FURNACES FOR COAL OR WOOD.

E. & C. GURNEY & CO.,
MONTREAL.



Bundy Radiators for Quick Circulation and Economy of Space.



Mining Regulations

TO GOVERN THE DISPOSAL OF

Mineral Lands other than Coal Lands, 1886.

THESE REGULATIONS shall be applicable to all Dominion Lands containing gold, silver, cinnabar, lead, tin, copper, petroleum, iron or other mineral deposits of economic value, with the exception of coal.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein either by surface or subterranean prospecting for mineral deposits, with a view to obtaining under the Regulations a mining location for the same but no mining location or mining claim shall be granted until the discovery of the vein, lode or deposit of mineral or metal within the limits of the location or claim.

QUARTZ MINING.

A location for mining, except for iron on veins, lodes or ledges of quartz or other rock in place shall not exceed forty acres in area. Its length shall not be more than three times its breadth and its surface boundary shall be four straight lines, the opposite sides of which shall be parallel, except where prior locations would prevent, in which case it may be of such a shape as may be approved of by the Superintendent of Mining.

Any person having discovered a mineral deposit may obtain a mining location therefor, in the manner set forth in the Regulations which provides for the character of the survey and the marks necessary to designate the location on the ground.

When the location has been marked conformably to the requirements of the Regulations, the claimant shall within sixty days thereafter, file with the local agent in the Dominion Land Office for the district in which the location is situated, a declaration or oath setting forth the circumstances of his discovery, and describing, as nearly as may be, the locality and dimensions of the claim marked out by him as aforesaid; and shall, along with such declaration, pay to the said agent an entry fee of FIVE DOLLARS. The agent's receipt for such fee will be the claimant's authority to enter into possession of the location applied for.

At any time before the expiration of FIVE years from the date of his obtaining the agent's receipt it shall be open to the claimant to purchase the location on filing with the local agent proof that he has expended not less than FIVE HUNDRED DOLLARS in actual mining operations on the same; but the claimant is required, before the expiration of each of the five years, to prove that he has performed not less than ONE HUNDRED DOLLARS' worth of labor during the year in the actual development of his claim, and at the same time obtain a renewal of his location receipt, for which he is required to pay a fee of FIVE DOLLARS.

The price to be paid for a mining location shall be at the rate of FIVE DOLLARS PER ACRE, cash, and the sum of FIFTY DOLLARS extra for the survey of the same.

No more than one mining location shall be granted to any individual claimant upon the same lode or vein.

IRON.

The Minister of the Interior may grant a location for the mining of iron, not exceeding 160 acres in area which shall be bounded by north and south and east and west lines astronomically, and its breadth shall equal its length. Provided that should any person making an application purporting to be for the purpose of

mining iron thus obtain, whether in good faith or fraudulently, possession of a valuable mineral deposit other than iron, his right in such deposit shall be restricted to the area prescribed by the Regulations for other minerals, and the rest of the location shall revert to the Crown for such disposition as the Minister may direct.

The regulations also provide for the manner in which land may be acquired for milling purposes, reduction works or other works incidental to mining operations.

Locations taken up prior to this date may, until the 1st of August, 1886, be re-marked and re-entered in conformity with the Regulations without payment of new fees in cases where no existing interests would thereby be prejudicially affected.

PLACER MINING.

The Regulations laid down in respect to quartz mining shall be applicable to placer mining as far as they relate to entries, entry fees, assignments, marking of localities, agents' receipts, and generally where they can be applied.

The nature and size of placer mining claims are provided for in the Regulations, including bar, dry bench, creek or hill diggings, and the RIGHTS AND DUTIES OF MINERS are fully set forth.

The Regulations apply also to

BED-ROCK FLUMES, DRAINAGE OF MINES AND DITCHES.

The GENERAL PROVISIONS of the Regulations include the interpretation of expressions used therein; how disputes shall be heard and adjudicated upon; under what circumstances miners shall be entitled to absent themselves from their locations or diggings, etc., etc.

THE SCHEDULE OF MINING REGULATIONS

Contains the forms to be observed in the drawing up of all documents such as:—

"Application and affidavit of discoverer of quartz mine." "Receipt for fee paid by applicant for mining location." "Receipt for fee on extension of time for purchase of a mining location." "Patent of a mining location." "Certificate of the assignment of a mining location." "Application for grant for placer mining and affidavit of applicant." "Grant for placer mining." "Certificate of the assignment of a placer mining claim." "Grant to a bed rock flume company." "Grant for drainage." "Grant of right to divert water and construct ditches."

Since the publication, in 1884, of the Mining Regulations to govern the disposal of Dominion Mineral Lands the same have been carefully and thoroughly revised with a view to ensure ample protection to the public interests, and at the same time to encourage the prospector and miner in order that the mineral resources may be made valuable by development.

COPIES OF THE REGULATIONS MAY BE OBTAINED UPON APPLICATION TO THE DEPARTMENT OF THE INTERIOR

A. M. BURGESS,

Deputy Minister of the Interior.

TORONTO BAG WORKS

MANUFACTURERS OF

BAGS for ORES, PHOSPHATES, ETC.,

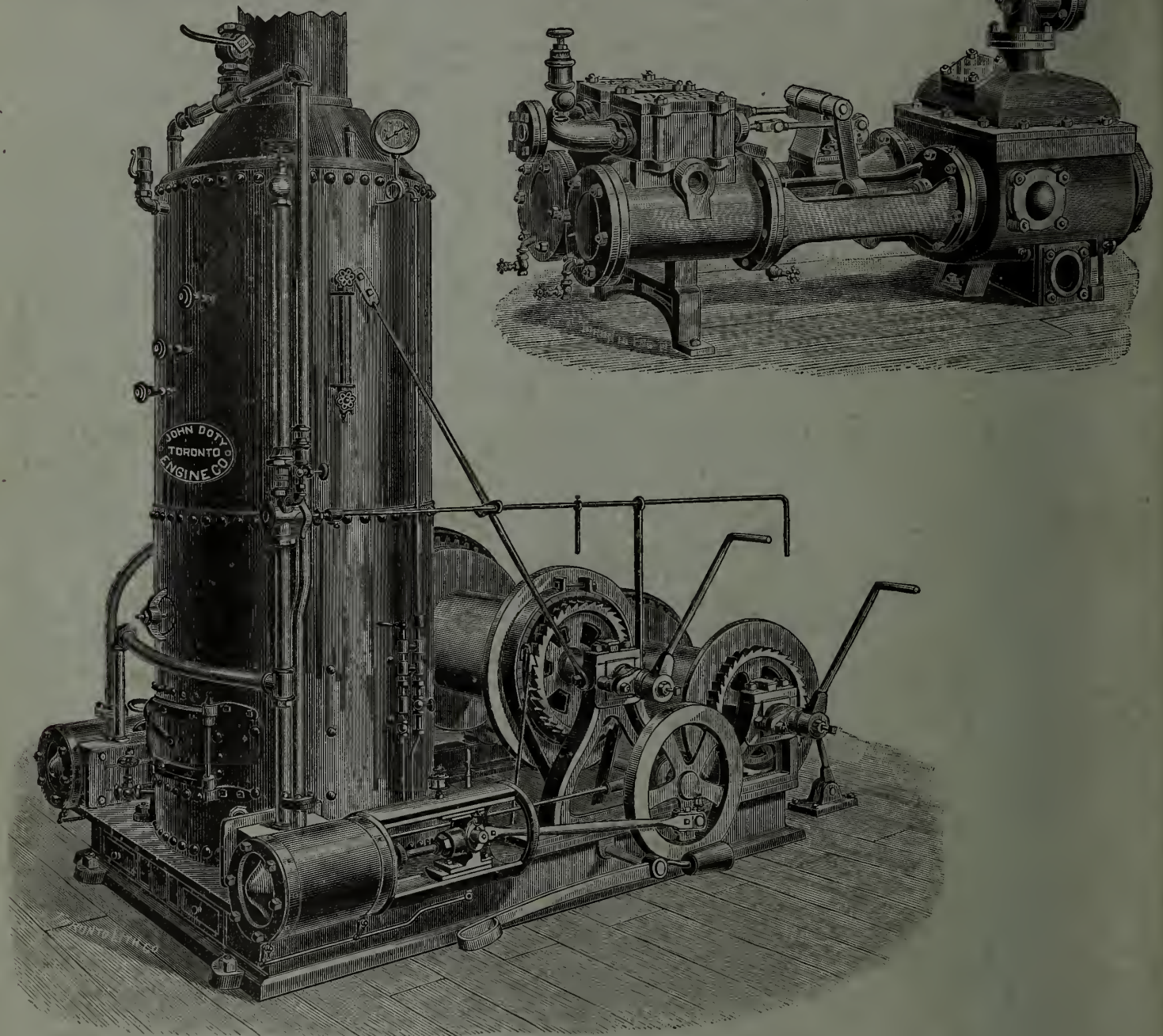
AND FOR ALL OTHER PURPOSES.

DICK, RIDOUT & CO.,

11 and 13 Front St. East,

TORONTO.

A. R. WILLIAMS,
SOHO MACHINE WORKS,
TORONTO, ONTARIO.
MANUFACTURER AND DEALER IN
MACHINERY AND SUPPLIES.



Duplex Steam Pumps, all sizes. Every Pump Guaranteed.
VERY LOW PRICES.

Portable Engines, Hoisting Engines, Stationary Engines, Iron
and Wood Working Machinery, Ventilating Fans, Saw Mill
and Shingle Mill Machinery. Full lines of Machinery and
Supplies. Send for Catalogue.

MINING REVIEW

Canadian

Established 1882

Vol. VIII.—No. 2.

1889.—OTTAWA, FEBRUARY—1889.

Vol. VIII.—No. 2

THE STANDARD AMERICAN ROCK DRILLING
and AIR COMPRESSING MACHINERY.

WRITE TO US.



SEND FOR CATALOGUE.

The Highest American Tunneling Record.

Hamilton Powder

COMPANY,

Manufacture Mining, Blasting, Military
and Sporting

Gunpowder,

DYNAMITE, DAULIN, and the new

ECLIPSE MINING POWDER

DOMINION AGENTS FOR

Safety Fuse, Electric Blasting
Apparatus, &c.

OFFICE

103 ST. FRANCOIS XAVIER STREET
MONTREAL.

BRANCH OFFICES & MAGAZINES
at all chief distributing points
in Canada.

CANADA ATLANTIC RAILWAY.

THE SHORTEST PASSENGER ROUTE
BETWEEN

Ottawa and Montreal,
AND ALL POINTS EAST & SOUTH.

The only road in Canada running trains lighted
with electricity and heated by steam from the
engine. Luxurious Buffet Pullman Palace Cars
on all trains between Ottawa and Montreal. Only
line running through Sleeping Cars between

Ottawa, Boston and New York

And all New England and New York points.

Baggage checked to all points and passed by Cus-
toms in transit.

During season of navigation close connections
are made with Richelieu and Ontario Navigation
Company's Steamers at Coteau Landing, shooting
the St. Lawrence Rapids.

For Tickets, Time Tables and information apply
to nearest agent, or to

S. EBBS, City Passenger Agent,
24 Sparks St., OTTAWA.

GEO. H. PHILLIPS, Gen. Agent,
VALLEYFIELD.

A. E. CAIRNS, General Agent,
136 St. James St., MONTREAL.

Or at 260 Washington St., Boston, and
317 Broadway, New York.

PERCY R. TODD,
General Passenger Agent.

E. J. CHAMBERLIN,
General Manager,
General Offices, Ottawa.

THE CANADIAN RUBBER CO. OF MONTREAL.

A. ALLAN, Pres. J. O. GRAVEL, Secy.-Treas. F. SCHOLES, M'g. Dir.

Manufacturers of Superior Quality Rubber Goods.

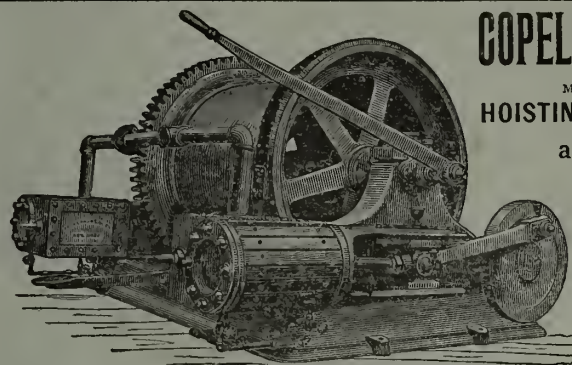
Our Rubber Belting is Unequalled in America.

Rubber Packings of All kinds. Rubber Engine, Hydrant, Suction,
Steam, Brewers' and Fire Hose.

MOULDED GOODS OF EVERY DESCRIPTION.

Western Branch cor. Toronto and Yonge Sts.,
TORONTO.

J. R. WALKER, Manager.



COPELAND & BACON

MANUFACTURERS OF
HOISTING ENGINES,
and MINING PLANTS.

85 Liberty St.
NEW YORK.

Send for Catalogue.

MILLER BROS. & MITCHELL

MANUFACTURERS OF

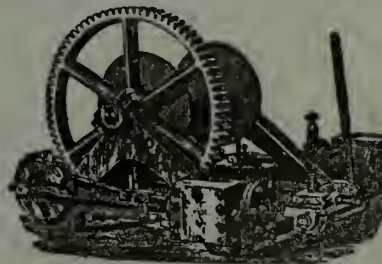
Steam Rock Drills

AND

HOISTING ENGINES,

Mining & Contractors' Plant.
&c., &c.

110 TO 120 KING STREET, MONTREAL, QUE.



THE BELL TELEPHONE CO. OF CANADA.

ANDREW ROBERTSON, - - PRESIDENT
C. F. SISE, - - - VICE-PRESIDENT
C. P. SCLATER, - SECRETARY-TREASURER

HEAD OFFICE, - MONTREAL.

H. C. BAKER, Manager Ontario Department,
HAMILTON.

This Company will sell its instruments at prices
ranging from \$10 to \$25 per set. These instru-
ments are under the protection of the Company's
patents, and purchasers are therefore entirely free
from risk of litigation.

This Company will arrange to connect places
not having telegraphic facilities with the nearest
telegraph office, or it will build private lines for
firms or individuals, connecting their places of
business or residences. It is also prepared to
manufacture all kinds of electrical apparatus.

Full particulars can be obtained at the Com-
pany's offices as above, or at St. John, N.B., Hal-
ifax, N.S., Winnipeg, Man., Victoria, B.C.



MISS M. E. ORR.

REMINGTON STANDARD TYPEWRITER

Miss Orr, Championship
of the world and Gold Medal
at Toronto, 13th August,
1888.

GEORGE BENGOUGH,
GENERAL AGENT,
36 King Street, TORONTO.

ALEX. FLECK, JUN.,

Manufacturer of every Description of

Mill Machinery,

Water Wheels, Steam Engines,
Boilers, Derricks. Steam
Pumps and Mining
Machinery.

Brass and Iron Casting of every
Description.

VULCAN IRON WORKS, WELLINGTON ST.
OTTAWA.

DYNAMO ELECTRIC MACHINES and LAMPS



THE
BALL ELECTRIC LIGHT CO. LD.
MANUFACTURERS OF

ELECTRIC LIGHTING APPARATUS
57, ADELAIDE ST. W.
TORONTO
ONT.

ARC and INCANDESCENT

FOR MINING PURPOSES

LIDGERWOOD MANUF'G CO.

96 LIBERTY ST, NEW YORK,

Largest Manufacturers in the United States of Hoisting Machinery of Every Description for Mines, Tunnel Work, Contractors, and General Hoisting Purposes.

IMPROVED HOISTING ENGINES

FOR MINING PURPOSES A SPECIALTY.

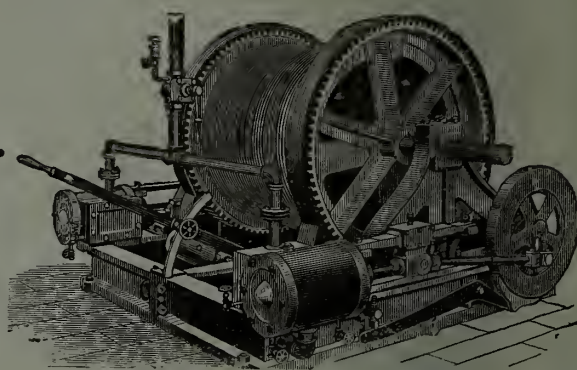
Over 5,000 Engines in Use!

300 Styles
and Sizes.

Send for
CATALOGUE.



FRICITION DRUM PORTABLE HOISTING ENGINE.



Double Cylinder Reversible Mine Engine.

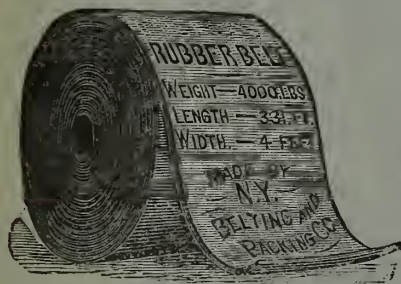
New York Belting & Packing Co.

15 PARK ROW, NEW YORK

JOHN H. CHEEVER, Treasurer.

J. D. CHEEVER, Dep'y Treasurer.

Oldest and largest Manufacturers in the United States of



RUBBER BELTING.

CIRCULAR WOVEN SEAMLESS, ANTI-SEPTIC RUBBER LINED

"CABLE" HOSE & TEST HOSE

For the use of Steam Engines, Force Pumps, Rolling Mills, Iron Works, Factories, etc. Woven in a superior manner to insure wear, compactness and durability.



"TEST HOSE."

VULCANIZED RUBBER FABRICS

FOR MECHANICAL PURPOSES.

EXTRA RUBBER BELTING AND HOSE

FOR MINING PURPOSES.



Emery Vulcanite Wheel.

SOLID VULCANITE EMERY WHEELS

(Large Wheels made on iron centers)

Cuts Cooler and Freer than any other other wheel in the market.

W. D. ALLAN & CO.,
151 Lake St., Chicago.

European Branch: Pickhuben, 5, Hamburg (Freihafengebeit), Germany.

H. D. EDWARDS & CO.,
Detroit.

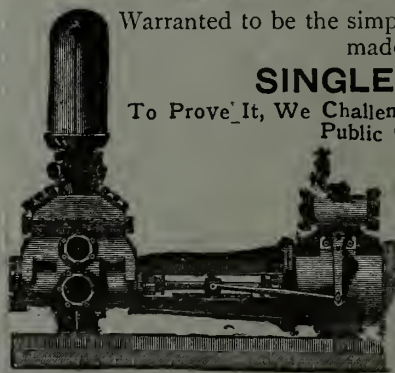
The M. T. DAVIDSON

IMPROVED MINING PUMP.

Warranted to be the simplest and most efficient Steam Pump made, whether it be

SINGLE OR DUPLEX.

To Prove It, We Challenge All Makers of Steam Pumps to a Public Competitive Test.



COMPOUND PUMPING ENGINES,

Obtaining a higher duty than any direct-acting pump made.

MANUFACTURED BY THE

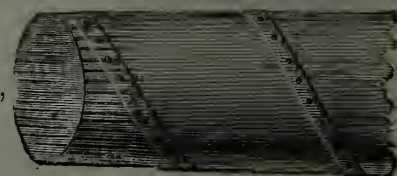
Davidson Steam Pump COMPANY,

New York Office, - - - 77 Liberty Street.

ROOTS'S SPIRAL RIVETED PIPE

FOR

Hydraulic Mining,
Water Works,
Ranch and Railroad
Water Supplies.



From 2 to 24 inches in diameter and 1 to 25 in length. Manufactured with fittings to suit, capable of withstanding any desired pressure.

ABENDROTH & ROOT MFG. CO.

28 Cliff Street, New York.

Chicago Branch, - - SMITH & KNAPP, 312 Dearborn Street

Francis D. Taylor
MINING ENGINEER,
CKVILLE, - ONTARIO

SPECIALTY. — The Mining of Iron Ores,
and the Manufacture of Iron and Steel.

T. has had for many years the manage-
ment of large mining enterprises in England
and U. S. A.

CAMERON STEAM PUMP
SIMPLE, RELIABLE, COMPACT, DURABLE.
NO OUTSIDE VALVE GEAR.
THE A. S. CAMERON STEAM PUMP WORKS.
ADAPTED FOR ALL PURPOSES.
FOOT OF EAST 23rd STREET, NEW YORK.



J. STEWART,
Provincial Land Surveyor,
AND
CIVIL ENGINEER,
Office: — Over H. F. MacCarthy's Drug Store,
Wellington St., Ottawa, Ont.

TAYLOR McVEITY,
Barrister, Solicitor, &c.,
Supreme Court and Departmental Agent,
SCOTTISH ONTARIO CHAMBERS, OTTAWA.

WM. HAMILTON MERRITT, F.G.
Associate Royal School of Mines, &c.,
Mining Engineer and Metallurgist,
Will report on Mines and Mineral Properties.
ADDRESS:
15 TORONTO ST., TORONTO, ONT.

J. T. DONALD, M.A.,
Analytical Chemist and Assayer,
124 St. JAMES St. - MONTREAL.
Analyses and Assays of every description. Manufactur-
ing processes practically tested. Laboratory instruction
in Chemistry, Assaying and Mineralogy. Terms on
application.

SCIENTIFIC AMERICAN

ESTABLISHED 1845.

is the oldest and most popular scientific and
mechanical paper published and has the largest
circulation of any paper of its class in the world.
Fully illustrated. Best class of Wood Engrav-
ings. Published weekly. Send for specimen
copy. Price \$3 a year. Four months' trial, \$1.
MUNN & CO., PUBLISHERS, 361 Broadway, N. Y.

ARCHITECTS & BUILDERS

Edition of Scientific American.

A great success. Each issue contains colored
lithographic plates of country and city residen-
ces or public buildings. Numerous engravings
and full plans and specifications for the use of
such as contemplate building. Price \$2.50 a year,
25 cts. a copy. MUNN & CO., PUBLISHERS.

PATENTS
may be secured by apply-
ing to MUNN
& Co., who
have had over
40 years' experience and have made over
100,000 applications for American and For-
eign patents. Send for Handbook. Corre-
spondence strictly confidential.

TRADE MARKS.

In case your mark is not registered in the Pat-
ent Office, apply to MUNN & Co., and procure
immediate protection. Send for Handbook.

COPYRIGHTS for books, charts, maps,
etc., quickly procured. Address

MUNN & CO., Patent Solicitors.

GENERAL OFFICE: 361 BROADWAY, N. Y.



ONTARIO Mining Regulations.

The following summary of the principal
provisions of the General Mining Act of
the Province of Ontario is published for
the information of those interested in
mining matters in the Algoma District,
and that part of the Nipissing District
north of the Mattawan River, Lake Nipis-
sing and French River.

Any person or persons may explore for
mines or minerals on any Crown Lands
surveyed or unsurveyed, not marked or
staked out or occupied.

The price of all lands sold as mining
locations or as lots in surveyed townships
is two dollars per acre cash, the pine timber
being reserved to the Crown. Patentees
or those claiming under them may cut and
use such trees as may be necessary for
building, fencing or fuel, or for any other
purpose essential to the working of mines.

Mining locations in unsurveyed territory
shall be rectangular in shape, and the
bearings of the outlines thereof shall be due
north and south, and due east and west
astronomically, and such locations shall be
one of the following dimensions, viz: eighty
chains in length by forty chains in width,
containing 320 acres, or forty chains square,
containing 160 acres, or forty chains in
length by twenty chains in width, con-
taining 80 acres.

All such locations must be surveyed by
a Provincial Land Surveyor, and be con-
nected with some known point or boundary
at the cost of the applicant, who must file
with application surveyor's plan, field notes
and description of location applied for.

In all patents for mining locations a
reservation of five per cent. of the acreage
is made for roads.

Lands patented under the Mining Act
are free from all royalties or duties in re-
spect to any ores or minerals thereon, and
no reservation or exception of any mineral
is made in the patents.

Lands situated south of the Mattawan
River, Lake Nipissing and French River
are sold under the Mining Act at one
dollar per acre cash.

Affidavits showing no adverse occupa-
tion, improvement or claim should ac-
company applications to purchase.

A. S. HARDY,

Commissioner

Department of Crown Lands, Toronto.

The Canada Co.

Will issue Licences to Prospect or
to work Minerals on any of
their Mining Lands and
Mineral Reservations,

Covering nearly a

Quarter of a Million Acres

in Eastern Ontario, and principally
within the belts containing

Iron, Phosphate, Gold, Galena,
Plumbago, Mica, Marbles,
Building Stone,
and other valuable Minerals.

For list of lands and terms apply to the
Company's Mining Inspectors,

H. T. STRICKLAND,
Peterborough, Ont.,

for lands in the County of Hastings and
Steward, and to

ANDREW BELL, P.L.S.,
Almonte, Ont.,

for lands East of the County of Hastings.

TO MINERS AND OTHERS.

Bannerman & Powers,

VULCAN BOILER WORKS

423 and 340 Wellington St., Ottawa.

MANUFACTURERS OF

IRON AND STEEL COILERS

OF EVERY DESCRIPTION.

Tanks, Girders, Iron Roof-
ing, Bank Vaults, Smoke
Stacks

—AND ALL KINDS OF—

SHEET IRON WORK.

Repairs Neatly and Promptly Executed

Queen City Galvanizing Works,

SOLE MANUFACTURERS IN CANADA OF



WALTER'S
PATENT

Metallic Shingle

—AND—

SIDING PLATES.

Fire and Storm Proof. Easily ap-
plied. Make the handsomest roof known
and give double the service of the same
material put on by any other method.
Send for particulars.

Thomas McDonald & Co.,

69 to 75 Sherbourne St., Toronto, Ont.

PORTABLE ENGINES AND SAW-MILLS

Of all capacities—from 3000 feet of lumber and up per day.

Saw-Mills.

Shingle-Mills.

Lath-Mills.

Chopping-Mills.

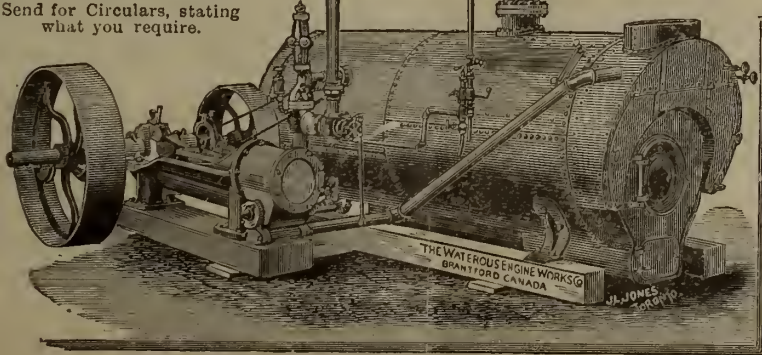
ENGINES

OF ALL SIZES.

BOILERS

of all capacities,
IRON OR STEEL,
ALL STYLES.

Send for Circulars, stating
what you require.



Waterous Engine Works Co. Brantford, Canada.
St. Paul, Minn., U.S.A.

Limestone Quarries Near Birmingham, Alabama.—The limestone quarries belonging to the Birmingham Mining and Manufacturing Company have only been recently opened up. In quarrying the stone compressed-air rock-drills are used. Holes are bored 30 feet in depth; they are then charged with dynamite, and blasts are made regularly twice a month, electricity being used to explode the dynamite. Each blast usually dislodges 10,000 tons.

ASBESTOS.

THEO. HAMEL,

44 Mountain Hill, Quebec,

SOLE ASBESTOS MANUFACTURER in CANADA

Write for prices and catalogue. Use Asbestos and save your money. Applied on boilers and Steam pipes it will prevent them from rusting and will economize 33% on fuel.

DYNAMITE.

AND OTHER EXPLOSIVES.

FINE CAST STEEL For Rock Drilling and all other Mining
Material constantly on hand.

McDOUGALL & CUZNER,

531 Sussex and 35 Duke Streets, OTTAWA.

A No. 1

Phosphate Property

ON RIDEAU LAKE

FOR SALE OR LEASE.

On favorable terms to party with not less than \$5,000 capital.
Highest grade mineral and inexhaustible quantity.

N. S. BENTLEY, 45 William St., New York.

W. Bredemeyer, Dr. Ph.

(LATE PARTNER OF JOHN McVICKER)

Mining Engineer, United States Surveyor and Assayer,

MASONIC TEMPLE BLOCK, VANCOUVER, B.C.

RELIABLE REPORTS, underground surveys and maps of mines executed at low rates. Assays made on all kinds of minerals, Gold and Silver Bars. Thirty years' experience in mining in Asia, Europe and United States of America. Speaks ten languages. Assays from a distance promptly attended to.

Address Vancouver, B.C.

Ottawa Boiler and Bridge Works

478-480-482 } OTTAWA { 476-478-480
Maria St. } Gloucester St.

W. J. CAMPBELL & CO

MANUFACTURERS OF

STEAM ENGINES, BOILERS,
TANKS, MINING PAILS,
DUMP-CARS

And every description of Wrought
Iron Work.

MINING WORK A SPECIALTY.

N.B.—Every Attention given to repairing by Experienced Workmen.

JAMES HOPE & CO.

BOOKSELLERS,

Stationers, Bookbinders and Printers,
OTTAWA.

Safety Dynamite.—One of the most fruitful sources of accident in the use of dynamite is the thawing process which has to be resorted to in cold weather; as dynamite solidifies and becomes frozen at a comparatively high temperature. Miners and quarrymen are, or should be, always provided with simple apparatus for safely thawing frozen dynamite, but, unfortunately, they are greatly addicted to the reprehensible practice of placing it on the hob of a fireplace or in the oven, in order to save time and trouble. The result of these malpractices are but too frequently premature explosion and loss of life. If, therefore, dynamite could be rendered uncongealable by removing the freezing point, the thawing process would not have to be resorted to, and accidents from dangerous and prohibited methods of carrying it out could not occur. This is exactly what Herr von Dahmen has done in the safety dynamite invented by him. By the addition of a very simple substance, itself an explosive, he has succeeded in rendering dynamite uncongealable, and therefore in causing it to remain permanently plastic; and this is effected without diminishing its explosive force after having been subjected to exceedingly low temperatures. Safety dynamite is slightly more powerful than ordinary dynamite, owing to the ingredient which prevents it from freezing being an explosive. In some experiments lately carried out with the two kinds of explosives, cartridges of each were exposed to a temperature of minus 15° to 20° Centigrade for twenty-four hours—minus 15° Centigrade corresponding to zero Fahrenheit, or 32 degrees below freezing. At the moment of use the two explosives had a temperature of minus 15° Cent. The ordinary dynamite was frozen as hard as a piece of wood, so that the capped fuse could not be inserted in it, but was tied to the bare dynamite. Only the detonator exploded, scattering the inert dynamite about in fragments. The safety dynamite, at the same temperature, remained perfectly soft and plastic, and the capped fuse was easily inserted in the body of the cartridge. The explosion and its results were similar to those of similar charges of safety dynamite which had not been subjected to the action of the freezing apparatus. A cartridge of safety dynamite taken from the freezing apparatus and having the capped fuse tied to it (as in the case of the ordinary dynamite when frozen hard) was exploded with perfectly satisfactory results. These experiments prove that Herr von Dahmen has succeeded in eliminating the freezing point from dynamite, or at least in so far lowering it that it cannot at present be reached. By so doing he has greatly enhanced its safety and practical value. Time will not have to be expended in thawing it, nor will dangerous practices have to be resorted to by the thoughtless and foolhardy in carrying out that process in the rash hope of saving a little of that time. In addition to this, safety dynamite can be used with full useful effect at temperatures at which ordinary dynamite is inert and useless.—*Times*.

Compressed Fuel.—We are informed that a machine has been designed and patented to make coal dust into fuel in an entirely novel form, and at a very low cost. The first machine, which is the property of a strong Liverpool syndicate, is now in process of construction, and it is computed that it will compress and turn out ready for use about 30 tons of fuel per day. It is intended to form a limited company to work the invention, and they anticipate a very large sale, both for the machines and for the fuel, which, it is stated, will be considerably cheaper than ordinary coal.—*Colliery Guardian*.

W. Blakemore, F.G.S., M.E.,
Member of I. & S.I.

A. Montgomery Evans, M.E.,
of Canada & U.S.

BLAKEMORE & EVANS, MINING & CIVIL ENGINEERS Exchange Buildings, Cardiff, S.W.

LONDON OFFICE:

Robert H. Jones, 82 Queen St., Cheapside, London, E.C.

Reports, Estimates, and Valuations made on Iron and Steel Works,
Blast Furnaces, and all classes of Mining Properties.

CANADIAN BUSINESS PROMPTLY ATTENDED TO.

To Prevent Boiler Explosions

And other accidents to steam boilers, and to secure economy in working, insure with

THE BOILER INSPECTION AND INSURANCE COMPANY OF CANADA.

Sir Alex. Campbell, K.C.M.G., | John L. Blaikie, Esq.
President. Vice-Pres.

HEAD OFFICE: TORONTO

G. C. ROBB, Chief Engineer.

A. FRASER, Sec'y-Treas.

ORFORD COPPER CO., COPPER SMELTERS.

Works at Constable's Hook, N.J., opposite new Brighton, Staten Island. Copper Ore, Mattes, or Bullion purchased. Advances made on consignments for refining and sale. Specialty made of Silver-Bearing Ores and Mattes.

SELL

INGOT AND CAKE COPPER.

President, ROBERT M. THOMPSON,

Treasurer, G. A. LAND.

Office, 37 to 39 Wall Street, New York.

Robin & Sadler, MANUFACTURERS OF LEATHER BELTING.

TRY OUR

Waterproof Belting,

Just the thing for Mining Machinery.

MONTREAL,

2518, 2520, 2522 Notre Dame St.

TORONTO,

129 Bay Street.

STEEL IN STORE "JESSOP'S"

Standard Durable Cast Steel. Best value for consumers.

Also Machinery Steel.

A. C. LESLIE & CO., Montreal and Toronto.

T. D. LEDYARD, DEALER IN MINERAL LANDS 4 ONTARIO CHAMBERS, TORONTO.

Will buy undeveloped iron ore and other mineral properties.
WANTED.—Deposits of Magnetic Iron Ore, Red Hematite, Brown Hematite, Galena, Iron and Copper Pyrites, Mica, Soapstone, Marble, Gypsum, Baryta. Samples can be sent by Sample Post for 1 cent for 4 oz. or up to 24 oz. in weight.
Information regarding mines cheerfully given. Correspondence solicited. Crown Land Business attended to.

CHEMICAL APPARATUS! OF EVERY DESCRIPTION.



Glass, Porcelain, Stoneware, Platinum, Crucibles of every sort, Analytical Scales and Weights, Fine Chemicals and Reagents, including Volumetric Solutions. Every requisite for Analysis or Experiment. For Sale by

LYMAN, SONS & CO.,
384 St. Paul St., Montreal.

Illustrated Catalogue mailed on receipt of 10c. or Business Card.

Boiler For Sale.

AN EIGHTY H.P. TUBULAR STEEL BOILER made by W. C. White, Montreal, 15 ft. x 5 ft. 4 in.—eighty 3½ in. tubes; smoke stack 45 ft. long; guy-lards and guys. Very little used. Equal to new. Price on cars, \$600. Address

P. O. Box 6,
MONTREAL.

Johnston's Fluid Beef



The
Great
Strength
Giver.

The benefits experienced from taking Johnston's Fluid Beef regularly are very great. It has a double effect. It acts as a tonic,

STRENGTHENING DIGESTION.

and containing, as it does, all the Life-giving properties of meat, it Nourishes and Invigorates the System.

Victor Electric Fuses.

Superior to all others for Exploding any make of Dynamite, High Explosives, or Gelatine Powder. Each Fuse is tested and warranted extra strong and waterproof. Low grades of Dynamite Powder will do ten per cent. more execution if detonated with Victor Electric Fuses.

VICTOR BLASTING MACHINES.

Latest improvements, made in three sizes, easy to operate, strong and durable. No expensive repairs, low in price, will fire any make of Electric Fuses.

MANUFACTURED ONLY BY

JAMES MACBETH & CO.,

128 Maiden Lane, N.Y., U.S.A.

Send for Catalogue.

FOR SALE.

A COAL MINE IN CAPE BRETON,

Area, 970 acres, underlaid by 6 or 7 beds of the best Coal in Nova Scotia. The property is estimated to contain from 50 to 60 million tons of Coal. No Coal Mine can be more easily or cheaply operated. The angle of dip is 6 degrees, and the rock stratification is remarkably even and without fault or break.

Apply to

ALEXANDER CAMPBELL,
Annapolis Royal, N.S.

12th, 1888.

British Boiler Explosions.—It can hardly be regarded as satisfactory that, notwithstanding the combined efforts of legislation, and of inventors of safety-promoting appliances and improvements in boiler construction, the number of boiler explosions and the consequent loss of life which took place during the statistical twelve months embraced in the period (1887-1888) just reported upon by the Secretary of the Board of Trade upon the working of the Boiler Explosion Act of 1862, shows no improvement, but what can be only regarded as retrogression. During the 12 months referred to the number of boiler explosions was 61, and the number of lives lost thereby 31. In the five twelve months previous the figures were:—

Year.	Cases.	Lives lost.
1882-83.....	45	35
1883-84.....	41	18
1884-85.....	43	40
1885-86.....	57	33
1886-87.....	37	24

Of the past year's disasters the chief cause has again been the practice of using boilers which are either worn out or are seriously defective; 31 out of the 61 explosions were attributable to this, while of the remaining 30, 17 were due to defective designs and fittings, or undue working pressure, seven to ignorance or neglect of the attendants, and six to miscellaneous causes.

Improvements in Safety Appliances in Pit Shafts. The most recent invention for securing safety while raising or lowering men and materials in mine shafts is an apparatus patented by Mr. Henry James Warrington, mining engineer, and Mr. Albert Mayer, mechanical engineer, at the Berry Hill Collieries and Ironworks, near Hanley, Staffordshire. Pairs of gates are fixed at the entrance of roadways or insets in mines or in any place where cages, lifts, or hoists, or other means of raising or lowering persons or things acted by suspended ropes or chains. The gates communicate by means of levers with a lever slightly projecting into the pit shaft or inset. As the cage, lift or hoist passes up and down, it comes into contact with and presses against the projecting lever in such a way as to move the levers communicating with the gates, which are thereby kept open while the cage, lift or hoist remains in position to receive wagons or men, and to reclose the gates as soon as the cage, lift or hoist has passed above or below. The projecting lever can be pulled back and prevented from working if desired, still leaving the gates closed. Levers are attached to the bottom of the gates, which, by means of connecting rods, block the line of rails when the gates close, and leave the rails clear when the gates are open. What Messrs. Warrington and Mayer claim for the patents is the arrangement and construction of mechanism for automatically opening and closing the gates fixed at the entrance of roadways or insets of mine shafts, consisting of levers attached to the gate-posts and connected through rocking shafts and connecting rods to a lever, one end of which is made to project into the pit shaft, so that the passing cage presses it up or down and opens the gates, which, after the passing of the cage, are automatically closed by means of the counter-weight on one of the rocking shafts; also the arrangement of blocking apparatus, consisting of a sliding bolt or bar for blocking the rails, which sliding bolt or bar is actuated by an arm on one of the gate-posts acting through a rocking-shaft and connecting rods. The apparatus will soon be brought into practical operation at Berry Hill. Meanwhile, we

have had an opportunity of inspecting a large model. The arrangement seems easy of application, and renders next to impossible an accident in consequence of any one falling down the pit mouth or into the sump from the pit bottom or from any intermediate workings. One of her Majesty's inspectors of mines, and also other scientific gentleman, have seen the model, and pronounced the apparatus to be admirable for the saving of life and property. There is at the same works a model of an adaption of the same principle for warehouses, hotels, or any other large buildings where hoists are needed, one, two, or more stories high. It is undoubted that the application of this system would greatly reduce the number of accidents.—*Colliery Guardian.*

ALEX. RANKIN,

20 Toronto Street, Toronto Ont.

Agent for sale of Mines and Mineral Lands

CORRESPONDENCE SOLICITED.

Agents in England and New York.

E. H. SARGENT & CO.,

IMPORTERS AND DEALERS IN

ASSAYER'S MATERIALS,

Chemicals and Laboratory Supplies.

125 State Street,

CHICAGO.

THIS YEAR'S

MYRTLE

CUT AND PLUG

Smoking Tobacco

FINER THAN EVER.

SEE

T & B

In Bronze on Each Plug and Package.

THE DOMINION

SAFETY BOILER CO.

MANUFACTURERS OF

The "Field-Stirling" Patent High Pressure Boiler,

The Safest and Cheapest Steam-Generator now in Use.

This Boiler is unusually durable, being made of the best steel and wrought iron exclusively. No cast-iron is employed. It is simple in construction, has a rapid, well-defined circulation, and a large cool mud-drum, where all impurities are collected to be blown off. All parts of the Boiler are readily accessible for the closest inspection. It has great excess of strength and is not liable to be strained by unequal expansion. The water space is divided into sections so arranged that NO EXPLOSION IS POSSIBLE.

Some of Our Leading Customers:

The J. A. Converse Mfg. Co. (A. W. Morris & Bro.), Montreal; The Canada Sugar Refining Co., Montreal; The Pillow and Hersey Mfg., Montreal; The Berthier Beet Root Sugar Co., Berthier, Que.; The Imperial Insurance Co., Montreal; The Massey Manufacturing Co., Toronto; The Acadia Coal Co. (Lt'd.), Stellarton, N.S.; Canada Paper Co., Windsor Mills, Que.; Royal Electric Co. (Central Station), Montreal; Dodge Wood Split Pulley Co., Toronto, and a repeat order from A. W. Morris & Bro., after five months' experience; Ingersoll Rock Drill Co. of Canada.

We guarantee Dry Steam and Great Economy of Fuel. Correspondence Solicited.

J. FRASER TORRANCE, M.E.,

P.O. Box 1707, Montreal.

Manager.

SPEIGHT & VanNOSTRAND,

*Dominion and Provincial Land Surveyors,
Draughtsmen, Valuers, &c.*

OFFICE: ROOM "J," FIRST FLOOR, TORONTO ARCADE,
YONGE ST., TORONTO.

Surveys, Plans, Descriptions of Properties, etc., promptly executed.
Timber Limits and Mining Claims Located.

MILLAR & CO.

General Merchants & Shipping Agents

ATLANTIC CHAMBERS,

209 COMMISSIONER ST., - MONTREAL

Cable address, "Hoyer, Montreal." P.O. Box 1095.

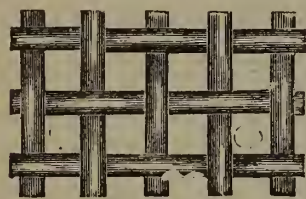
AGENT FOR The Canadian Phosphate Co., Ltd., of London, Eng.,
The Montreal Union Abattoir Co., of Montreal, Can.

English Correspondents Messrs. Couper, McCamie & Co., London, England.

DEALERS IN Canada Phosphate, Ground Phosphate, Sulphate of Ammonia, Nitrate of Soda, Spent Bone Black, Hoofs and Horns, Fertilizers, Tankage, Dried Blood, Grease, Bones, Hair, etc., etc., etc.



For Mining Hoisting Derricks, etc.



Strong Wire Cloth and Screens

For Mining, etc., manufactured by

B. Greening & Co.

HAMILTON, ONT.

NATIONAL COLONIZATION

Lottery!

UNDER THE PATRONAGE OF

THE REV. FATHER LABELLE.

*Established in 1884 under the Act of Quebec, 31 Viet.,
Chap. 36, for the benefit of the Diocesan Societies
of Colonization of the Province of Quebec.*

CLASS D.

DRAWINGS ON THIRD WEDNESDAY IN EVERY
MONTH AT 2 P.M.

Prizes value \$50,000

Capital Prize: 1 Real Estate worth \$5,000.

LIST OF PRIZES.

1 Real Estate worth	\$5,000	\$5,000
1 Real Estate worth	2,000	2,000
1 Real Estate worth	1,000	1,000
4 Real Estates	500	2,000
10 Real Estates	300	3,000
30 Furniture Sets	200	6,000
60 Furniture Sets	100	6,000
20 Gold Watches	50	10,000
1000 Silver Watches	10	10,000
1000 Toilet Sets	5	5,000

2307 Prizes worth

\$50,000

Tickets, \$1.00!

Offers are made to all winners to pay their prizes cash,
less a commission of 10 p. c. Winners' names not published
unless specially authorized.

S. E. LEFEBVRE, Secretary

Office: 19 St. James St., Montreal, Can.

Carbonic Acid Gas In Mines.—The fact that a few days ago three men were suffocated in an ironstone mine at Cleator Moor by carbonic acid gas, shows how necessary it is that all mines should be ventilated to such an extent as to prevent accumulation of gases in them. In all mines, it may be stated, carbonic acid gas is produced in more or less quantities, by the breathing of the work people, by putrid fermentations, by the combustion of lights, and that it is generated by fire, as was the case at Cleator Moor. When the gas is inhaled it acts as a poison, and combined with atmospheric air in a greater proportion than 8 per cent. there is danger of suffocation. Even when inhaled in small quantities, as no doubt it is in almost every mine, its effect is injurious, yet there is no difficulty in keeping the quantity down to such a proportion that it will not affect those who have to spend many hours daily underground and where it accumulates. The great antidote is fresh air, and this under ordinary circumstances there should not be the slightest difficulty in providing. Yet carbonic acid gas can be utilized for various purposes, even in connection with mining. When the air contains only one-tenth part of it a fire can be extinguished by its means, and water dissolves a volume nearly equal to its own by atmospheric pressure, whilst notwithstanding the peculiar properties which all gases possess of mixing with each other, the carbonic acid, owing to its great specific gravity, is always found accumulated in the lowest parts of our mines—hence the necessity of making the air permeate every portion of underground workings, so that the gas can do no injury to the men whilst following their employment. At Cleator Moor, however, a fire had taken place causing the men to be suffocated by the gas given off. Yet carbonic acid gas is the most effectual extinguisher of fire, and there is no doubt that it is the principal ingredient used by certain of those who invent fire extinguishers. In Germany, carbonic acid gas is compressed into a liquid state and placed in a receiver of sufficient strength to bear a pressure of 250 lbs. to the square inch, and is then by means of pipes sent into a receptacle made for the purpose of receiving it, and in this state it has become an article of considerable commercial value, for when a fire takes place the liquid can be taken direct to it, and being thrown on to it combustion becomes impossible, and the flames are speedily put out. Instead, therefore, of the gas being allowed to remain in a mine to the injury of all concerned, there does not appear to be any reason why it should not be drawn off, made of some value, and by this means render mines healthy. Carbonated hydrogen, or firedamp, as it is generally termed, the greatest foe hitherto known to the coal miner, has been rendered harmless, and instead of being looked upon as dangerous and destructive, has been utilized. At the Wurm Mines, near Aix-la-Chapelle, long noted for the large quantities of firedamp given off, the director of the mines has been able to draw away the damp by means of a suction pump and of a conduit, wire gauze being placed in the latter leading to a gasometer, from which pipes lead to two generators, which are heated by steam. If this can be done with firedamp—the lightest of all gases (it is always found in the roof where it is given off in the mine)—there should be even less difficulty with carbonic acid gas, which in all mines accumulates at the bottom.—*Colliery Guardian.*

M. BEATTY & SONS,

WELLAND, ONT.

HOISTING

ENGINES

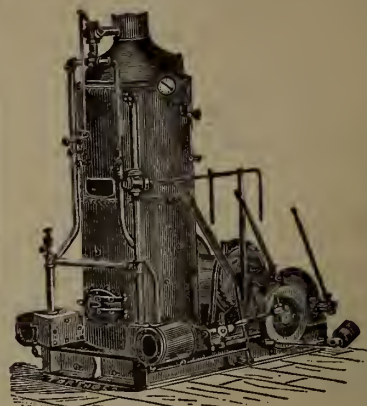
ENGINES

FOR

Mines

AND

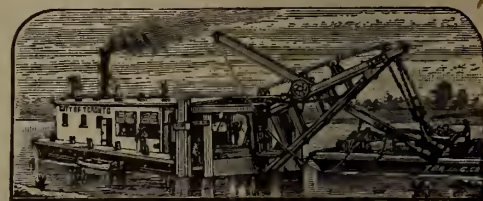
Inclines



Horse-Power Hoisters,

Stone Derrick Irons,

Centrifugal Pumps.



DREDGES,

DERRICKS,

STEAM SHOVELS,

And other Contractors' Plant.

WORKS

—BY—

Professor E. J. CHAPMAN

Published by the COPE, CLARK CO. (LIMITED), TORONTO.

I.

MINERALS AND GEOLOGY OF CENTRAL CANADA,
COMPRISING THE PROVINCES OF ONTARIO AND QUEBEC.

Third Edition.

With 250 wood-cuts and a copious Index.

II.

AN OUTLINE OF THE GEOLOGY OF CANADA,
INCLUDING ALL THE PROVINCES OF THE DOMINION.

With six sketch-maps and six plates of characteristic fossils.

III.

BLOWPIPE PRACTICE.

WITH ORIGINAL TABLES FOR THE DETERMINATION OF
ALL KNOWN MINERALS.

This work has been favourably noticed in the 11th and 12th editions
of Von Kobell's celebrated *Tafeln zur Bestimmung
der Mineralien.*

IV.

PRACTICAL INSTRUCTIONS

FOR THE DETERMINATION BY FURNACE ASSAY OF GOLD AND
SILVER IN ROCKS AND ORES.

Second Edition.

V.

THE MINERAL INDICATOR:

A PRACTICAL GUIDE TO THE DETERMINATION OF GENERALLY-
OCCURRING MINERALS.

In preparation—A SYNOPSIS OF MINING GEOLOGY.

A Motor for Coal Hauling Purposes.

This motor, which has been designed by Mr. J. B. Corey for use in hauling coal from the pit, is mounted on a truck 16 feet long. The boiler is horizontal, with working cylinders attached to its side. The rope used in hauling is coiled round a grooved wheel which has cogs on either side. These cogs mesh with a small gear-wheel on the engine shaft. The slack of the rope is taken up by levers which regulate the tension. The machine is in successful use.

The Canadian Mining Review

CONDUCTED BY - - - B. T. A. BELL

OFFICES:

UNION CHAMBERS, 14 Metcalfe St.

OTTAWA.

Vol. VIII. FEBRUARY, 1889. No. 2.

The Springhill Coal Trouble.

Much has been said and written of late with reference to the injustice of the Intercolonial railway in having suddenly and without notice sprung upon the coal companies a rise of one-tenth of a cent per ton per mile on the freight rate on coal from the Nova Scotia collieries to the upper Provinces, which precipitate action has, it is alleged, seriously embarrassed the operations of these collieries. To us it did appear surprising that the Intercolonial authorities should act in so hasty a manner in such an important matter, giving no warning whatever to the managers of the mines that it was in contemplation to raise the rate. We have, however, made enquiry into this matter, and are informed that in June, 1883, notice was given that a rate of three-tenths of a cent per ton per mile would be fixed on coal going to the upper Provinces, which rate would remain in force for three years from that date. At the expiration of this period, in June, 1886, it was intimated to the managers of some of the collieries that it was the intention to raise the rate to five-tenths of a cent. The manager of the Springhill colliery pleaded that the companies had made contracts for the year on the old basis, and that it would be very prejudicial to the coal interests if the increased rate was put in force, and it was agreed to postpone it a year. It thus ran on until January, 1888, when the Springhill Coal Company wrote stating that they were about to tender for the supply of large quantities of coal to the Grand Trunk Railway. They were informed that it was in contemplation to raise the rate of freight over the Intercolonial railway to five-tenths of a cent per ton per mile, and other colliery companies were also notified the same spring of the intention to raise the rate five-tenths. The colliery companies after this entered into large contracts presumably based on the increased rate of freight, and therefore had the benefit of the delay in raising the rate until 1st December last. In the meantime the Springhill Company's directors had intimated that the five-tenths of a cent was too heavy a rise, that four-tenths would be acceptable, and on the 1st of December this rate went into force.

These are the facts as they have been related to us, and if they are as stated, the colliery companies appear to have been treated with more consideration than we had supposed.

The Ontario Mining Commission.

The Royal Commission on the Mineral Resources of Ontario having finished its field work and the recording of evidence at the mines, we propose to give a short sketch of the progress which the Commissioners have made up to the present time. Short accounts of their movements and of the evidence taken appeared from day to day in some of the Toronto papers, in the form of letters from their own correspondents with the Commission.

The object the Government had in view in appointing this Commission was "to inquire into and report upon the mineral resources of the Province and the best means for their development." It, therefore, became necessary for the Commissioners to visit the principal mines or mining districts in order to inspect them personally and to ascertain what is being done. While on their visits they took evidence, on oath, both verbally and in writing, from the different classes of mining men. After seeing for themselves and obtaining the opinions of those most familiar with the various mining properties, they are, no doubt, in a good position to form a sound judgment regarding them. They also obtained plans, sections and photographs of mines, quarries, machinery, etc., and as all the evidence was sworn to and recorded on the spot where the Commissioners had the means of checking it when advisable, it is much more reliable than if obtained in any other way.

They appear to have succeeded in ascertaining the views of all classes interested in mines or mining property from the wealthy capitalist to the poor prospector and explorer. In addition to the large amount of information which seems to have been gathered as to our mines and minerals, the witnesses examined were allowed to express their opinions or make any statements they wished on such subjects as the existing mining laws of Ontario and other countries, trade relations affecting our mineral resources, the difficulties or advantages, the aims or the hopes of mining men in Ontario. They had also submitted to them a variety of proposals regarding schools or courses of instruction for miners and prospectors, geological surveys, assay offices, stamp mills, smelting works, &c., with Government aid.

It will be remembered that the Commission consists of five members, John Charlton, M.P., chairman; Dr. R. Bell, the Assistant Director of the Geological Survey, W. H. Merritt, A.R.S.M., Wm. Coe, Esq., and A. Blue, Secretary. In order to save time and the better to cover the ground the Commissioners were seldom all employed in one section of the country at the same time. Messrs. Charlton, Blue and Merritt began work at Grand Manitoulin and La Cloche in the end of July. At Sault Ste. Marie they were joined by Dr. Bell, when the Garden River and Echo Lake regions were examined. A visit to the native copper mines of Maimansee and Michipicoten Island was next on the programme,

but had to be postponed. The party then proceeded to the township of Denison and thence to the Sudbury copper district, where much valuable information was obtained, a report of part of which has already appeared in these columns. The Commission then moved west to Port Arthur, where several sessions were held, and a visit was paid to the silver mines. After this the members separated, Messrs. Blue, Merritt and Coe going on to Lake of the Woods and afterwards by rail, via Winnipeg and Duluth, to the iron region which is now being worked at Tower in Northern Minnesota, for the purpose of comparing it with our own iron districts. In the meantime Dr. Bell, assisted by Mr. Donald McKellar, proceeded by canoe with a party of Indians to examine the gold-bearing veins of the Partridge Lake region and the great iron beds of the Antler River, about 150 miles west of Thunder Bay. Dr. Bell also explored the lead district lying beyond the township of Dorion, north of the Pacific Railway, and opposite the head of Black Bay, or considerably north of the lead mines previously reported on. Later in the season, Messrs. Blue, Merritt and Coe, visited the Bay of Quinte region, the route of the Kingston and Pembroke Railway and Ottawa city; and finally Dr. Bell and Mr. Merritt made a tour of the salt and gypsum regions and, along with Mr. Blue, the same gentlemen took evidence in the Enniskillen oil-field. A full meeting for taking evidence was held in Toronto in December, and when it adjourned Messrs. Charlton and Blue paid a visit to Washington and Pittsburg in the United States, in order to collect information on the working of mining laws and on iron smelting and natural gas, which will give additional value to the Report of the Commission.

This Report will be presented to the Legislature during the present session and will doubtless prove an interesting document, and we trust it will not be the last from the same source. The appointment of this Commission by the Ontario Government has given great satisfaction to all classes as a step in the right direction, and we hope it will be continued, and its field of usefulness enlarged, since a single season must have proved too short a time to complete the task it has undertaken. The public has manifested a lively interest in its labors, which have already demonstrated the necessity that existed for such a Commission, as well as the wisdom of our Provincial Government in appointing it.

Investments in England.

Extraordinary activity has prevailed in monetary circles in England during the past year. It was supposed that the many failures that had occurred among our limited companies and the stringent legislation concerning them would hinder their promotion; but we learn from published accounts that the very opposite has occurred.

"The returns of joint-stock enterprises at Somerset House for the year just ended are re-

garded as phenomenal. The aggregate capitals amounted to over £400,000,000, as against £168,000,000 in 1887. The returns for the month of December give capitals in the aggregate of £12,232,030, which amount accounts for 162 companies."

A private letter states: "One remarkable feature is the fact that so many of the large companies brought out are paying the investors. The result of all this floating of companies and arranging foreign loans has helped to make money dear and to tie up the funds of large financial houses in the City."

A late English paper says that the limited liability companies are corporations that have ability to lie without limit. But though this may be so, the investing public are beginning to profit by experience, and a good proportion of the companies they now sustain are worthy of existence.

In the United States capital is plentiful at present and money is to be had in New York at two per cent. per annum, but it is said that "capitalists are timorous and nothing less than a good electrical process of sugar refining will be able to tempt them."

Phosphate Prospects.

The prices of phosphate abroad are tending upward, mainly owing to the advance in ocean freights; but as Canada has as good a chance as ever of securing low ballast rates in the lumber vessels that need phosphate for "dead weight," it appears as though our miners might secure the benefit of the rise, which in case of phosphate carried from other countries goes mainly to the shipowners.

As regards the demand for Canadian product the prospect appears brighter than ever before. It is authoritatively stated that the deposits in the district of Somme, France, which have been so formidable a competitor of late will be exhausted in about two years, and there are even reports that the Carolina output is likely to become less. When it is considered that these deposits in the Carolines are usually only from 12 to 18 inches thick lying in a horizontal layer, it can be believed that the output of half a million tons yearly must ere long begin to tell upon even the vast area through which they extend.

During the past few days we have had cables from London which show that this state of things is having an effect in our favour. The agricultural editor of the London *Times*, Mr. Henry F. Moore, who visited Canada last fall and took particular interest in the subject of our phosphates during his stay in Ottawa, makes this important reference:

"In the discussion which has followed the publication of these facts it has been pointed out that in taking such a pessimist view of the situation Mr. Hermann Voss, the author of a paper read before the Chemical Manure Manufacturers' Association, probably did not allow for the fact that in Canada the phosphate industry is in its infancy; or for the extent of the phosphate lands and the richness of the deposits. This is a matter well worthy of attention, not only from the fact that it appeals to our patriotism, but also because of the interests involved. One of the greatest sources of the future

wealth of Canada probably lies in the development of such mineral deposits as are found in the phosphate lands in the valleys of the Lièvre. There are as yet but very small spots tapped, and these are, as a rule, worked by Americans. It has been only within the past few years that a few fore-seeing Canadians have realized the value of these deposits, and even now the chemical manure manufacturers do not seem to be alive to the question. But, in view of the scarcity of, and increasing demand for, phosphates, it may be well to point out that in our nearest large colony we have a source of supply which ought to be worked by British capital, for the benefit of British agriculture. It is impossible to avoid a reference to the *furor* now going on in connection with nitrates, and the large amounts of money now being sent out to South America. It is impossible to see any agricultural demand for nitrates to warrant this, and it must not be forgotten that, as a plant food, nitrates are mere stimulants whose effect is evanescent, and that, if not immediately made use of, they are washed away and lost to agriculture and lost to wealth, whereas the equally simile, the nitrate is like a glass of spirits, while the phosphate may be compared to a plate of beef. The cry of the manure manufacturers should be answered by attention being directed to the rich phosphate deposits of Canada."

In the *Morning Post* Dr. Fream also has much to say on the subject. As to the value of the deposits, he remarks:

"The extensive deposits of apatite in Canada, occurring in Ottawa county and along the banks of the Lièvre River, are familiar enough to geologists. These deposits have for some years been the seat of a quietly progressive industry, and freight trains laden with the apple-green mineral are no unusual sight in this region of the Provinces of Ontario and Quebec. These extensive beds of one of the best known of the mineral phosphates of lime are likely to undergo great development in the near future, and thereby our supply of raw phosphates should be for a long time secure, unless, as is certainly not improbable, the local demand in Canada, as in South Carolina, should compel us again to look elsewhere."

Another very noticeable feature is the prominence given to our phosphate industry in the report just issued by our own Minister of Agriculture. After reviewing in an interesting manner the work done at the mines in 1888, the Minister says:

"I continue to hope that the time is not far distant when our own farmers will see the advisability of using this fertilizer at home, which would have the effect of largely increasing this mining industry. Latest advices from Great Britain show that Canadian phosphate is prominently engaging the attention of super-phosphate manufacturers in that country, and the enormous deposits in this vicinity may be expected to receive thereby still more attention than has been the case in the past. I am informed that British agriculturists have been discussing of late the present position of their supplies of phosphate, that most essential element of plant food * * * At this moment, therefore, special attention is being drawn to our Canadian deposits."

Other phosphates may work out but the Canadian phosphate like Tennyson's brook may sing, "I go on for ever." Though phosphate seams are irregular and often disappointing, still they persist downward, and on those properties where a good number of seams exist, so that several pits can be worked, a good result is probable, for when one seam is pinching another expands, and the average of all furnishes a good result. Occasionally a single pit is found to be sufficient for successful work, but as a rule a multiplication of chances is desirable in this as in other undertakings.

An English letter dated December 22 says, "Trade here on the whole is better; the manure manufacturers are energetically looking into their business and have had a large meeting in London. The question of supplies is being talked of and it is particularly noted that all

the Somme phosphate that is at present known of will be worked out in three or four years. On the whole things seem to indicate a further outlook for deposits of good stuff, such as exist in Canada, and land sales should become possible at remunerative figures."

The Ontario Land, Timber and Mining Regulations.

We have received from Messrs. Carswell & Co., Toronto, a very handy little volume containing a complete set of the Acts respecting land, timber, mining, game, streams, etc., for the province of Ontario, carefully compiled, and with explanatory notes by Mr. H. R. Hardy, barrister-at-law, Toronto. The book is neatly gotten up and should be of great value to miners, lumberman locaters, and settlers on free grant lands; we can also commend it to the attention of the legal profession to whom it will serve as a convenient hand-book. The notes on the various Acts are explicit and comprehensive. The price of the book is one dollar.

"He Never Will Be Missed?"

We learn upon very good authority that C. M. De Tracey Dobson, an individual styling himself a mining expert, and who has recently been posing very prominently in this capacity in the Toronto press, has departed to a more congenial clime. The many and varied peculiarities which have so distinguished this party's career since he first made our acquaintance some three years ago, would prove most interesting reading had we space to give it in detail. It is sufficient to add that his departure from Canada is a positive gain to the mining community. Chicago papers please copy.

LETTERS TO THE EDITOR.

Natural Gas in Canada.

PITTSBURG, February 4th, 1889.

The Editor

THE CANADIAN MINING REVIEW:

Sir,—I see from a copy of the *REVIEW* for the month of November, '88, in which Prof. Alfred R.C. Selwyn calls attention to a reported interview with myself, published in the *American Manufacturer* of this city. I was in Colorado the last three months of last year and did not receive the *REVIEW* until the first of this year, and sickness in my family for the past month has prevented my replying until now.

I did not see the *American Manufacturer* of August 24th, '88, nor was I ever interviewed by a reporter of that publication that I am aware of. In July last I visited the province of Quebec, Canada, and after my return I was visited by a reporter of the press of this city, and in the interview I said that I did not think it was possible for the Trenton formation to produce gas or oil in paying quantities in the Province of Quebec, where the Trenton limestone out-

rops at the surface, or where the Trenton limestone had but a slight covering above it; but I expressed no opinion in regard to Canada. I know of no reason why gas and oil should not be found in the Province of Ontario, and in the North-West Territory in paying quantities, as Prof. Selwyn suggests. I am,

Yours, etc.,

E. C. BEARDSLEY.

The Springfield Coal Trouble.

NEW GLASGOW, N. S., 20th Feb., 1889.

The Editor

THE CANADIAN MINING REVIEW:

SIR,—The Intercolonial railway has increased its freight rates on coal to such an extent that it virtually closes the Montreal market for rail shipments, and will enable the Americans to lay coal down in Montreal by rail at a lower rate even than the Springhill collieries, which are the nearest mines to that city. Our former rate from New Glasgow to Montreal was \$2.80 per ton of 2,240 lbs. This has now been increased to \$3.46 per short ton of 2,000 lbs., which, I think you will admit, is a very large advance. For instance, a car of 20½ tons, say from Stellarton to St. John, Que., used to cost \$60.88; the new rate makes it cost \$81.65, or a difference of \$20.87 per car, or about \$1.00 per ton.

That the management of the Intercolonial has made a very great mistake in this matter, is admitted by everyone, but mismanagement on this line is no uncommon thing, and it ever will be so, as long as the business of the road is conducted as it now is.

I am, etc.,

COLLIER.

Mining Economics.

VANCOUVER, B. C., 10th Feb., 1889.

The Editor

THE CANADIAN MINING REVIEW:

SIR,—I think I may state, without fear of any contradiction, that mining consists in producing the greatest possible results at the smallest expenditure of time, labour or money, as the results are effected by these factors. In respect to industrial or any active pursuit time implies labour, otherwise suspense, both of which conditions relatively influence results in one direction or another. What would be a satisfactory return of an investment for one year would be very unsatisfactory if the same investment only aggregated as much in ten years, and just as great a difference may eventuate, and often does, from the exercise of rigid economy, and, *vice versa*, from the neglect of it. Economy is much more frequently hackneyed in expression than it is honoured in practice. It is one of the prudential virtues, or one of the virtues of prudence, or the prudence of virtue itself, whose principles are not generally well understood. Niggardliness is no part of it, conduces not to it; but, rather to the contrary, tacitly opposes itself to its proper action, impedes its progress, and vitiates, if it does not utterly exclude, its beneficial purposes and designs. True economy embraces the salient feature of opposite extremes. It is liberal and conservative, but judiciously so in each regard—liberal when generous subscriptions to one end will proportionately accomplish greater and better results than if a sparing hand had been exercised and the essential aid to its accomplishment withheld or curtailed; on the other hand, it is

conservative where doubt is implied and where it is not evident that a suspension or abridgment of generosity means the conservation of so much money. In respect to mining it pertains to purchases, including the mine itself, or the rights acquired in regard to it; the adaptability, utility and application of mechanism, material and manual employments. Also of its produce—its conservation when required in the crude state, the cost and completeness of its reduction, whether to the metallic state or approximately by concentration or other mechanical manual appliances. There is latitude here for laxity and waste, but equal scope for economy and gain, apart from the detail of practical proceedings, which I do not propose to enter into on this occasion; but I will merely state in passing that there is nothing more pernicious or fatal in the exercise of economy in the underground department of mines than the working them on day work, that is, to pay so much per day, as is prevalent on this continent, whatever the qualifications of the men may be, their skill and general competency. The emulation is retrograde and downwards, the best and most experienced hands trying "how not to do it," in order to equalize the efficiency of their services with that of the unskilled, unpractical and unequal co-miners. Their remuneration being alike, why should not the amount and value of their labour and service (in irony of reason) be equal? Any superintendent of mines or railroads has made this observation. I have no hesitation in stating that until this pernicious system and custom is abolished, economy in one of the most vital departments of practical and profitable mining can never prevail. It came, without doubt, I think, from the employment of practically incompetent and ignorant superintendents in the first place, and agreeing with the majesty of labour on this continent was readily and generally adopted, stereotyped and established—not permanently; it is to be hoped that can and never will be. It can easily be dispensed with and relegated to the limbo of inconsistencies, and be superseded by a method more manly, rational, consistent and profitable. Let all underground work, or so much of it as can, as in Germany and England, in fact all over Europe, be done on contract, and for a time, at least until the system becomes recognized and understood, be open to all competitors. It would soon be found that, from the affinity which skilled labour has for its kind, an evolution would ensue from the process of such rational and natural selection as patent and potent as the development of species according to the Darwinian theory ("which would be good and true if the missing link was found") by which the fittest would survive. Each then would soon find his proper place and level, as experienced men are never willing to share the proceeds of their labour with incompetent partners, and emulation would be rife in different sections of the mine, each one trying to outvie with others in the despatch of work, prompted by the laudable ambition of superior excellence and its consequent pecuniary advantages. Of the auxiliary sciences pertaining to mining the two most important are mechanical philosophy, engineering, and experimental chemistry. There can be no doubt but that mechanical engineering is equal to all the requirements of modern mining, to whatever extent or depth it has been or may be prosecuted; it is only a question of adaption—its proper application and economy. But experimental chemistry, in its relation to the practical reduction and value of ores—that is, on a commercial, workable scale—of the pre-

cious and other metals, appears until recently to have been, if not totally inactive, very much neglected. It seems strange, from what is now known of the humid process recently introduced on this continent, that experimentation in respect of it should not have been rife a quarter or more of a century ago, seeing that thousands of tons of good ore were excluded from reduction by amalgamation by heavy charges, a serious percentage of loss demanded for and incident to the working by that method. The new process has caused an entire revolution in silver mining, and silver and gold associated. In a country like this, where we have all kinds of ores, ranging from a few dollars to fifty and hundreds per ton—the higher grade value considered medium—as a less value would not ordinarily be remunerative to the miner assaying to mine his own ores in such districts where as yet there is no ready railroad communication, and having reduced them at a Customs mill, the difference between which and the profitable working of ores of considerably less than half of the minimum value as above, say ten to twenty dollars per ton, is a *desideratum* to both companies and miners of incalculable value, not to be over-rated or likely to be fully appraised at its true worth until taught by experience, so great is the change. Companies will realize more largely than private individuals by the improved method, as they may be premised to qualify and provide for every utility of economy and gain by providing their own reduction works, as conveniently arranged and suitably adjusted as possible, which very few, if any, independent prospectors or individual miners are able to do. A twenty stamp battery will reduce for the leeching process thirty tons per day, the cost of which and its further reduction to the metallic state, together with the higher average percentage at which the ores can be worked, will amount to from ten to fifteen dollars per ton, and, as in this province for that kind of work Chinese and Indian labour can be employed, to even much less than that sum, as compared with the best appointed amalgamating appliances, or a difference on the lowest calculation on a capital of \$500,000 of \$100,000 per annum, equal to a profit of 20 per cent. difference between the two methods. I am convinced that I neither over-rate nor exaggerate the difference or the result, and when it is remembered that immense quantities of ores which will not begin to pay by the old prevalent method of their reduction by amalgamation will be profitably available by the leeching process, it is not too much to affirm that a new era has dawned upon mining in this province as soon as the leeching and Russell methods are introduced here, and that what heretofore were regarded as profitless enterprises, in many instances even worse than profitless, may now be hailed and regarded with almost unerring confidence as prolific sources of wealth, amply sufficient to remunerate their patrons and supporters and creditably figure in the annals and prestige of any state or province. Besides which, recently undeveloped fields of mineral wealth will burst into prominence, because hitherto unregarded from the customary cost of reducing the ores added to the almost prohibitory intermediary charges; the entire proceeds of much more than good average ores were very frequently engulfed. As a producer from the raw material from which the metals of commerce are extracted—in other words, a miner largely interested in the results of economics of this or any other kind—I hail the advent of the above mentioned new processes, as it has already revolutionized silver mining over the greater part of this continent, and should

be adopted everywhere, transposing the principal terms of a trite dictum, and render success in mining the rule instead of the exception. I am fully convinced that it is the province of economy, and within its legitimate scope, to effect changes in mining the result of which, if prosecuted to its normal limits, would not only perfect the revolution referred to, but eliminate from it the stigma of being, as in its preliminary stages it is supposed to be, a haphazard enterprise. I have already stated that economy presupposes prudence, and so no industry has greater scope for its exercise from beginning to end than that of mining. It is not one but a many sided system—a system of many parts, from some of which outlets are necessarily open, which, if not properly guarded, exhausting and exhaustive life-blood may both exude and be drawn from its veins, its currents vitiated at the fountain head, its procedure encumbered, and achievements lamentably disappointing. It is most unaccountable, from a rational point of view, that correct business principles upon which so much depends, are so sedulously excluded and so generally ignored in respect of this great industry. It is not the hot haste betrayed for dividends—dividends at any sacrifice, at any cost, regardless of the consequences which so much precipitancy may entail. Investment is lost sight of, supplanted by speculation of the wildest and most reckless kind—stockboard enterprises, the result of which pro and con are set down to the credit or debit of mining, to its debit most frequently. But, *nil desperandum*, the case is not hopeless; order from such confusions of the past will be adduced, and is so to some extent. The solid things in mining are the most permanently impressive, productive and lucrative, and, however agreeably and fascinatingly the similitude of truth may be usurped by fiction, it is but a resemblance of and (within rigid limitations) an imitation of its stern, eternal features and superficial parts. In mining, as in everything else, the fittest will survive, and the time will and has come, hastened by the force of events, chiefly from the realization of intrinsic values, augmented by successive improvements in the applied mechanism of practical purposes and the equally important improvements and economics introduced for converting our ores into metals, the effect of which will be to testify and prove that mining on its merits is more satisfactory and profitable than gambling in stocks, influenced by excitements ranging from blood to fever heat.

W. BREDEMAYER, M.E.,

Cost of Timber in Mining.—How enormous the item of expense for mine timber may become is well known by the reports of the Comstock mines. This proposition is confirmed by Mr. S. F. Parrish, who states that the Crysolite Mine at Leadville, a locality where the Nevada system of square timbering has been perhaps unavoidably followed, during twelve years has used 19,890,864 feet b.m. of timber, 200,000 feet having been used above ground and the vast remainder under ground. This has been largely in logs 12 feet long and 12 inches square. It has cost at the mine \$135,135. It is certainly the duty of mining engineers to study this subject thoroughly, and to reduce to a minimum the burial of timber in mines.

On the 15th instant the Director and Staff of the Geological Survey gave a most delightful conversation in the Museum at Ottawa. Lord and Lady Stanley and suite and many distinguished persons were present.

PHOSPHATE.

In General.

We have it on the authority of Mr. W. J. Poupore, M.P.P., that the proposed bill by the Provincial Legislature to tax the output of phosphate has been withdrawn.

We repeatedly hear complaints from the miners on the Lievre that the facilities at present provided by the Canadian Pacific Railway is wholly insufficient to meet the demands of their important industry, and the construction of raised storage bins at the Buckingham landing is urgently needed for the accommodation of the rapidly increasing traffic at this point. A prominent miner has suggested that the railway authorities would do well to send one of their recently purchased steam cranes, so as to handle the mineral expeditiously.

B. L. Nowell, of the Fertilizing Company, 93 Common street, Montreal, charged at the instance of James Macfarlane with obtaining money, aggregating upwards of \$1,200, under false pretences, was on 19th inst. committed for trial to the Court of Queen's Bench.

Market.

Advices from England give the following interesting and valuable information:

"Manufacturers in this country have been able to sell superphosphate for export to a very large extent; in fact they have latterly been declining orders or they would have been short of supplies for their own home customers, and consequently, orders for supers for spring delivery are getting somewhat difficult to place; this means that as spring comes on manufacturers will be bare of stuff and large buying will probably take place.

"Farmers pretty generally have had concessions made to them, while stocks on their hands have increased in value twenty to thirty per cent, and agricultural produce is selling freely at good rates; consequently, farmers are likely to be in a better position to pay their manure accounts than they have been for some time.

"Charleston Rock Phosphate which was selling last year at this time for 7½d. per unit, went up till sales were made at 9½d, but latterly business has been done at 9d. As this rock yields much more to the manufacturers than Canadian phosphate, per centage for per centage on allowance has to be made in calculating relative prices, and it is thought to be fair to add about ten units. Thus, if Charleston 55 per cent. is worth 9d., Canadian 65 per cent ought to be worth 9d., and this gives 10d. for 70 per cent.

"The firm that has been working the syndicate which controls the French phosphates from the district of Somme is finding it exceedingly difficult to make deliveries, owing to high freights, and scarcity of tonnage, and in consequence have put their price up to a prohibitory point and asks 13d. which nobody pays.

"The position for the coming season must largely be determined by the question of freight. If freight rates are maintained or no serious reduction takes place we would expect to get 10d. for 70 per cent, 11½d. for 75 per cent. and 13d. for 80 per cent, and we think it is quite possible that ½d. more than this may be obtainable as there is generally in Canadian phosphate

about a halfpenny difference between a market when buyers are enquiring for it and a market when no enquiries are being made and you have to go to the buyers to sell the stuff.

"Charleston freights went up from 12s. 6d. to 27s. 6d. and if the supply of Charleston and Somme is restricted in the spring by high freights, it would be a great help in selling Canadian phosphate.

"At present it appears that the bulk of the increased prices paid in this country will go into the shipowners pockets, but as manufacturers are getting bare of stocks we may manage to get a share of the farmer's money and if tonnage at a reasonable rate could be secured the result to sellers of phosphate in Canada ought to be better than it has been for years. But if owing to the large amount of new tonnage, and other causes, freights should fall in the spring, the prices we have indicated for phosphate here will probably not be procurable."

Freight.

Cable offers have been received from England of 2,400 tons of freight for next season at 10s. per ton. But in view of the large fleet expected to load lumber, which will require phosphate for ballast, much lower rates are expected to prevail.

Sales.

About 500 tons of 80 per cent phosphate have been sold to Germany at 12½d. and several thousand tons of 65 to 70 per cent phosphate have been sold to England on the basis of 8½d. for 65, 2,000 tons of ground phosphate have been sold to the United States and further quantities will be taken in that market.

Latest quotations to hand quote offers at 8d. for 65 per cent, and 9d. for 70 per cent. with 5d. rise. Sellers offering at a farthing advance.

Lievre District.

Some important developments during the month are announced from the Little Rapids mines. A body of high grade ore has been exposed in an abandoned pit showing a vein six feet in width at the bottom. A large quantity of reserve high grade mineral is to be seen at these mines.

Mr. W. W. Pickford informs us that an endeavour is being made this month to increase the output at High Rock to one thousand tons, and at time of writing there is every prospect of this being accomplished. When the shortness of the month is considered (24 working days) this will be remarkably good work, and a record for these mines. As it has been found that the present fleet is inadequate for the work of the mines, a new scow 70 feet long with a capacity of 85 tons is being constructed.

Templeton District.

Mr. Robert Blackburn states that the new cut at his mines is looking well and work thereon is making rapid progress. The product from these mines for the winter will be fully up to the average of former years. From fifteen to twenty teams are daily employed hauling phosphate to the river.

Kingston District.

Capt. Boyd Smith of Washington, and the proprietor of the well known Blessington mines, sailed for Europe on 30th ult. on business in connection with his phosphate interests. A large business in mining and lumbering is contemplated at his properties in this district. The sawmill is nearly ready for work, and a large number of logs are now banked ready for opera-

ions. Little mining has been done since winter began, but a reopening of the pits is to take place shortly, and a large force of miners is to be employed.

At the Foxton mines work is going on vigorously. A blast fired on the 12th threw down 20 tons of high grade. About 400 tons of the mineral are ready for hauling, and the mine still continues to improve.

Mr Hibbard has found phosphate at the Ell Lake Tunnel.

Mr. Spalding reports favorable prospects on his property, and states that he has recently crossed some small seams that look well.

Mr. Trenholme has struck a paying vein at Mud Lake.

MINING NOTES.

We shall be greatly obliged to mine owners and superintendents for such authentic reports of their operations as may concern shareholders and the public.

Nova Scotia.

The chief topic of conversation among the coal mining communities of Cumberland and Pictou counties has been the increase in freight rates on coal from these counties to Montreal via Intercolonial and Grand Trunk railways, which came into force on the 1st of February. There can be little doubt that this increase in the tariff will affect the principal collieries, and especially those at Springhill, where over 1,000 men and boys are already thrown out of employment. The old rate from Springhill was \$2.40 per long ton, while the new tariff is \$3.05 per short ton, or an increase of 86 cents per ton. How the matter will be met and dealt with remains to be seen. For the sake of the unfortunates' families—numbering close upon 4,000 persons—who are thus deprived of the means of earning a living, it is to be hoped that some arrangement satisfactory to both parties will be made. The Pictou county collieries have not as yet felt the increase so keenly as those at Springhill.

Work at the Pictou mines continue to be fairly good, and up to the middle of the month there has been no snowstorms to interfere with railway traffic and cause stoppage at the mines.

The Black Diamond colliery pursues the even tenor of its way, working steadily, although with not a very large output. Very slow progress is being made with the drift, which is being driven to test the underlying seam of coal; it is reported that the rock so far encountered is exceedingly hard, much more so than was expected.

At the Drummond colliery, work may be said to be almost steady, but the output, although far above the average for the winter months, is far short of the capacity of the pits; preparatory work is being rapidly pushed forward in the new Lift, and an extensive body of coal will soon be opened there ready to meet the summer demand. Coal has been banked occasionally during the winter, and already quite a large quantity has accumulated. Mining has for the present been suspended in the Scott pit,

but it is hoped that on the opening of navigation operations will soon be in full blast again. Work will also, it is expected, then begin at their No. 4 slope, at which, in view of future requirements, some repairs are at present being made to the hoisting engine.

At the Acadia colliery, work is exceptionally good; very little time has been lost except that required in consequence of repairs to some of the machinery.

The reopening of the valuable pits at the Albion collieries is being vigorously pushed forward; at the Foord pit, despite many difficulties and obstacles, good progress is still made, and it is expected that the owners will soon be reaping a substantial and well merited reward for their indomitable perseverance and the enormous outlay entailed. At the No. 2 slope a new pump has been put in position; the handsome new Bank-house has been completed, and it is likely that operations upon an extensive scale will shortly be resumed.

At the Vale colliery nothing is being done by way of mining in the Sixfoot, or Greener seam, but in the old pit, the McBean seam, a very large force is employed, and at no mine in Pictou county has work during the winter been steadier. The output, in consequence, is probably greater than that of any winter since the opening of the mine.

There is no new discovery worthy of note to report as yet from Five Islands, Colchester county. The enterprising Americans carrying on prospecting operations there have, however, met with several small seams of coal in the drifts made. They are now sinking a trial shaft which at last reports was said to be giving very encouraging indications.

A party of Nova Scotia capitalists are doing some prospecting for coal at Economy, in Colchester county, and have, it is said, been rewarded by the discovery of a three feet seam.

The annual general meetings of the shareholders of the Cumberland Railway and Coal Company and the Londonderry Iron Company were held at Montreal on the 13th inst.

The following figures of the shipments of coal by rail west of Chaudere for the past 10 years have been furnished from official sources: 1879, 570 tons; 1880, 10,246 tons; 1881, 30,629 tons; 1882, 35,089 tons; 1883, 54,891 tons; 1884, 112,898 tons; 1885, 165,791 tons; 1886, 175,512 tons; 1887, 198,643 tons; 1888, 184,662 tons.

The falling off in shipments for last year from Spring Hill is due principally to a heavy flow of water in the slopes, which mastered the pumps, throwing the pits idle for a considerable period. In the early part of the year a fire occurred in the south slope, which may have retarded operations some.

The opening of the Joggins railway has given an impetus to the work at this mine, and the shipments show a gratifying increase. Under its present management it is expected to greatly increase the output at this mine. Sinking will be proceeded with at once. The total shipments were 43,255, of which 36,854 tons were round,

and 6,501 tons slack. This is the largest output yet recorded by us for this mine, and it is expected to double it this year. The pit worked 277 days, the average number of cutters on the roll was 82, the average number at work daily 52.

The Chignecto Colliery fell a little short in its shipments for 1888 as compared with former years. The capacity of the mine is limited, and no great efforts are being put forth to do a big business. The management is content to do a sure if small business.

Under the management of Mr. Joseph Hudson, the Victoria mine is going ahead. Work will be prosecuted vigorously this year, and the banking of coal will proceed immediately. Of the total shipments 5,712 tons were slack.

The shipments from the Gowrie collieries for 1888 consisted of 87,935 tons round, 20,437 tons slack, and 1,065 tons coke.

The shipments from the Caledonia mines are thought to have been some 500 tons in excess of 1887.

From the Reserve mines the shipments up to 1st January this year, were 94,690 tons round, and 17,211 slack.

Mr. J. H. Bartlett, of Montreal, well known in connection with the Canadian iron trade, has been at Pictou in the interest of the Pictou Coal and Iron Company of Montreal, and has obtained from the County Council a cash subsidy of \$20,000, as well as remission of all taxes for twenty years. Mr. Bartlett has made a contract with R. G. Reid, of Montreal, for the construction of a branch railway, ten miles long, leading to the iron mines, and the Dominion Government have arranged to operate the branch as a part of the Intercolonial and provide all the rolling stock. It is estimated that over ten million tons of iron ore can be easily and cheaply mined from the Pictou Coal and Iron Company's mines, which are only seven miles from the Pictou coal mines and ten miles from Atlantic tide water. The prospects of this company are splendid. The location of the blast furnaces has not yet been definitely settled.

The Glace Bay Mining Company have declared a 5 per cent. dividend. An offer of D. J. Kennedy on behalf of the American syndicate, to buy out the company at 75 cents on the dollar, per value of shares was declined; the Glace Bay Company refuses to be swallowed up by the monopoly that seeks to control the Cape Breton coal mines.

Senator Archibald, Messrs. McDougall (Cape Breton), McKeen, McDougall (Pictou), and other Maritime Province members have had an interview with the Ministers of Customs and Finance relative to the duty on bituminous coal. It appears that by the completion of the Massena Springs short line, Pittsburg and the Pennsylvania coal regions have been brought within 640 miles of Montreal, and the Maritime Province coal men are apprehensive that they will suffer in competition with the American coal fields. The delegation urged that the duty on bituminous coal, which at present is 60 cents a ton, should be increased in order to enable the coal producers of the Maritime Provinces to compete on fairly equitable terms with the Penn-

sylvania coal fields for the Montreal market. The deputation pointed out that since the introduction of the N. P. the coal output in Nova Scotia had increased by 500,000 tons.

The Dufferin Gold Mine, situated on the Atlantic Coast, about 90 miles east of the City of Halifax, Nova Scotia, is advertised to be sold by auction at that city on March next. We are informed that this property is one of great value, and has never been properly worked owing to a want of harmony between the partners. It is not subject to any rent-charge except municipal taxation (which it is stated would not exceed 50l. per annum), and a royalty to the Government of 2 per cent. on all the value of the gold produced. According to reports from experts the mine is only in its infancy at present, and these state that there is sufficient quartz now in sight to keep the present crusher running to its full capacity for more than 10 years. They also add that there is 40 to 50 feet between the veins which dip on each side of the anticlinal and cross cuts have been made through this space. About one-half of the material lying between, it is stated, is composed of milling ore which it would pay to crush.

A deputation from the Gold Miner's Club of Nova Scotia, will wait upon the Dominion Government early next month to urge the advisability of the establishment of an official Assay office and a school of mines. The attention of our readers is directed to the able advocacy of the claims of the gold mining community in this regard, in the paper by Mr. J. H. Townsend, published in another portion of the REVIEW.

Quebec.

Mr. Ed. Wertheim has left Germany to superintend his father's recently acquired asbestos property in Coleraine. Reports of the work so far accomplished under Capt. Larmouth are satisfactory.

All the Thetford mines are working full time this winter, in order to fill large orders for the mineral.

We understand that an English syndicate is now being formed in London, with a view to the extensive development of asbestos lands in the Eastern Townships.

The Johnstone asbestos Company shipped from the 15th of April until 31st December, 500 tons. Work at the mines last year was greatly retarded by wet weather.

The spar products of the Villeneuve mica mine are being successfully manufactured into porcelain ware. Mr. S. P. Fanchot, Buckingham, has some samples which, for excellence in quality, cannot be excelled.

Mr. W. H. Walker has recently added a number of substantial new buildings to his plumbago property on the Lievre.

The mines of the Excelsior Copper Company at Broughton continue to yield a good average output of excellent percentage.

Work at the new Rockland slate quarries is active, and in the spring an additional number of hands will be put on. The demand is constantly increasing, so much so that the company cannot overtake the orders.

The Memphramagog Mining Company is making application for incorporation. The object is the mining for gold, silver, copper or other metals or ores, or for fuel, plumbago, or other minerals, in the townships of Potton and Bolton, in the county of Brome and elsewhere in the Province. The principal place of business and the head office of said company will be at the Village of Eastman, in said county of Brome. The capital of the company will be fifty thousand dollars, being five hundred shares of one hundred dollars each, with power to increase the capital stock of the company to two hundred thousand dollars. The names, address, and calling of the applicants are William Warne, mining engineer; Charles Chester Smith, contractor; George Edgar Smith, contractor; Corles Corydon Eldridge, manufacturer, and John Eades, miner, all of the Village of Eastman, in the county of Brome; James Clark, farmer, of Saint Etienne de Bolton; Leander Libby, farmer, and Lyman Libby, farmer, both of Dillinton, in said county of Brome; Wm. Jamieson, farmer, of the village of Magog, in the county of Stanstead; Charles Albert Nutting, esquire, advocate, and Thomas Anson Knowlton, trader, both of the village of Waterloo, in the county of Shefford. And said Charles Chester Smith, William Warne, Leander Libby, William Jamieson and Thomas Anson Knowlton are to be the first or provisional directors of said company.

Public notice is given that the persons herein mentioned intend petitioning the lieutenant-governor of the Province of Quebec to obtain letters patent constituting the said persons and all others who may become shareholders in the company thereby created into a body politic and corporate for the purpose hereinafter mentioned. The name and style of said company will be "La Société Canadienne d'Etudes minières." The object of the company is to facilitate the development of mining industries in Canada generally and more particularly in the Province of Quebec, by having studies and analyses made by its engineers and by opening mines and quarries. The company intends, besides, to buy mines and quarries and to interest itself in mining business by participation, limited or otherwise. The chief place of business of the company will be in Montreal. The proposed amount of the capital stock is one hundred thousand dollars. The number of shares will be one thousand, each being of one hundred dollars. The first shareholders of said company are: MM. Schwob Moïse, trader, French vice-consul at Montreal; Dugas Calixte Aimé, judge of sessions, of Montreal; Grant, Charles Henry Albert, trader, of Montreal; Hall, John S., lawyer, member of Provincial Legislature, Montreal; De LaVallée Poussin, Ludovic, civil engineer, of Montreal; Werner, Edouard, of Montreal; Duquet, Cyrille, trader, of Quebec. Messrs. Schwob, Dugas and Grant will be first directors of the said company.

Notice is given that under "The Companies Act" letters patent have been issued under the Great Seal of Canada, bearing date the ninth day of January, 1889, incorporating William Thomas Costigan, merchant; Edward Kinke Greene, merchant; George Bull Burland, president British American Bank Note Company; James Cooper, merchant; George Durnford, chartered accountant, and David Hislop Ferguson, merchant, all of the City of Montreal, for the purposes of pulverizing, grinding, disintegrating, reducing and screening

all animal, vegetable and mineral substances, and all refractory materials of every nature; the acquiring, holding, working, vending and leasing of mineral lands and mineral deposits, and the manufacturing, selling and leasing of mills, plant and machinery of every description, the operations of the company to be carried out throughout the Dominion of Canada—by the name of "The Canada Pulverizing Company" (Limited), with a capital stock of fifteen thousand dollars divided into five hundred shares of one hundred dollars

Ontario.

Application will shortly be made to the Lieutenant-Governor in Council for the grant of a charter of incorporation by letters patent, under the provisions of the Ontario Joint Stock Companies "Letters Patent Act" by the Fuel Oil Company of Petrolia. The objects for which incorporation are sought are: to manufacture from crude petroleum oil, fuel oil, illuminating oil and other products thereof; to tank, pipe and warehouse crude petroleum oil and its products; to act as warehousemen, shippers and carriers of crude petroleum or other articles; to buy, sell, lease or acquire lands with power to sink artesian wells and to produce petroleum, salt or other substances, and to buy, sell, and deal in petroleum and its products and other articles of substances; to enter into contracts for any of the purposes aforesaid and to do all such matters and things as may be needful and useful in carrying on the business contemplated. The operations of the company are to be carried on in the Town of Petrolia. The amount of capital stock of the company is to be fifty thousand dollars.

"The test well," says the *Canada Manufacturer*, sunk about midway between Brantford and Paris to ascertain the probabilities of getting natural gas, reached a distance of 1,700 feet before operations were suspended. The drills pierced a bed of white rock about 300 feet down, which tested them severely, and twenty-four hours' work in it showed but few feet of progress. Lower down, however, a great depth of shale rock—about 125 feet—was bored in one day's work. The hole is now plugged and the machinery removed. It is believed by geologists that the rock formation farther north on Grand river, in the county of Waterloo, is such that better results can reasonably be expected. But it is believed that the chances are infinitely better still nearer Toronto. Four thousand dollars would pay all expenses of a test well, and it seems strange that the thing has not been undertaken in this city, where so much enterprise is exhibited in other directions."

Messrs. Smith & Lacey have their fine new plant, consisting of steam hoist, pumps etc. all in place and ready for work.

Natural gas has been struck at Kingsville, and the story that the well yields eight million feet a day reads as if it had absorbed a good amount of the actual outflow.

Sudbury District.

Accurate information as to the mining industries is often best obtained by questioning the miners who have worked upon the properties. An intelligent miner who has worked in the celebrated Copper Cliff Mine makes the following statements:—The property is now doing very well, and smelting works are erected to reduce the ore on the spot. The copper bearing ore occurs in large masses, sometimes 40 to 50 feet wide, and after working one of

these out perhaps 60 or 70 feet of barren rock will have to be worked through before another pass is struck. A shaft was sunk 100 feet in poor ground, and a drift was then made for 150 feet without results, when an immense mass of paying ore was found. The shaft is being sunk another 100 feet, and a drift will be run from the 200 feet level. The ore yields about 12 to 17 per cent. of copper and contains some nickel.

Since this was written we have received another report from the district announcing that the smelting works are running regularly, and will be making large quantities of matte to be shipped to the United States. Mr. H. T. McIntosh, Cleveland, the secretary-treasurer of the company, and Mr. G. Allen were recently at the mines, and we understand that both these gentlemen were so pleased with what they saw that it is not improbable that another smelter will be added at once.

Port Arthur District.

Nothing of special moment has occurred at the working mines during the past month. As before intimated, the stamp mills at the Beaver and Badger mines are being put in readiness for work so soon as the waters of Silver Creek begin to run. Another small pocket of extraordinary rich ore was recently encountered in the Shuniah Weachu mine.

The lead district east of Port Arthur is being examined by Mr. Peter McKellar, the most experienced geologist of the district, who will report more especially on some recent finds of argentiferous galena north of Black Bay. It is understood that a prominent western editor has engaged this gentleman to examine, when no objections, all promising locations and select average specimens, which will be submitted to eminent assayists in London and New York, and the result of report and specimens made public, in order that investors may know the solid facts on good authority. This will help to keep under those schemers who may attempt to float locations which are not deserving of the puffs which, unfortunately, some who know better, are apt to lend their name to. A few such deals may be the means of filling a few pockets, but the final result is always ruinous to a district.

A few sales of low-priced properties have recently taken place.

Large tracts of iron lands are still being taken up by shrewd speculative Americans north of Arrow and Whitefish Lakes, along the line of the located Port Arthur, Duluth and Western Railway, as well as in the vicinity of the Canadian Pacific Railway, near the Kaministiquia River, at which latter place several mining gangs are at work testing the ore deposits for Pittsburg parties.

The newly established tri-weekly mail stage to Silver Mountain is a great boon to that section and a petition has been forwarded to the provincial government to have the wagon road extended around the north shore of Whitefish Lake.

Port Arthur is justly concerned at present about securing for that town the promised mining school. Such an institution in the vicinity of so many and varied working mines would be well patronized and be of incalculable benefit, saving much loss and failure from unskilled efforts.

There is much talk of a smelter, but this would be premature until the railway to the mines is in operation. A small bonus from the Ontario Government would secure the immediate construction of this urgent necessity.

British Columbia.

The directors of the British Columbia Smelting Company, have decided that they would not wait any longer for a supply of water from the Vancouver Water works, but arrange to obtain the necessary quantities from other sources. The company has either in its ore bins or on the track in its yards, nineteen car loads of ore, and as soon as it can name the day when it actually commences smelting operations, other shipments will be sent forward. It is therefore now to be hoped that all the difficulties which have so much delayed this important enterprise have been overcome.

The annual meeting of the British Columbia Milling and Mining Company was held in their offices at Victoria on 7th inst. The directors of 1888 were unanimously re-elected for the current year, and they will meet in a few days to elect officers. The directors' and auditor's reports and the annual statements were presented and were adopted. Several amendments were then made to the constitution which will greatly facilitate the disposal of stock by the board. A discussion in regard to the general interests of the company occupied the balance of the time of the meeting, and satisfaction was expressed at the position of affairs. The company expect to find in 1889 a year of unrivalled prosperity.

The foreign coal shipments for the month of January from the different mines were as follows:—Vancouver Coal Company, 31,285 tons; Wellington mines, 10,400 tons; East Wellington, 2,180 tons; making a total foreign shipment for the month of 43,865 tons. Iron ore from Texada iron mines, 1,000 tons.

A joint stock company has been formed at Nanaimo embracing a number of gold mines in Texada, and is composed of Messrs. J. E. Jenkins, Richard Prowse, C. R. Miller, Alexander Esson, George Tippet and Wm. Fee. Messrs. C. R. Miller, J. E. Jenkins and Richard Prowse are the directors of the company.

Mr. J. L. Mudge, Assistant General Manager of the Anthracite Company, states that the work of development is being pushed forward at the mines with gratifying results. A new lead has been opened up about ten miles east of the present one, and a colliery will be established there. The further operations are extended the more certain it becomes that the deposits of coal are practically unlimited. It is expected that by May the output will be 350 tons daily, which will give employment to about 250 miners. The objective output is about 1,000 tons per day, and this will be reached several months before the end of the year. Machinery with this capacity is now being placed in position at the mines. Large orders have been received from San Francisco and Pacific Coast towns which are being filled as rapidly as the present facilities will permit.

The strike at the Wellington Collieries is at an end, and the miners have resumed work.

The New Vancouver Coal Mining and Land Company (Limited) was registered on the 30th ult., with a capital of £185,000 in £1 shares,

to take over as a going concern the existing Vancouver Coal Mining and Land Company (Limited), incorporated in 1862. The number of directors is not to be less than four nor more than six; qualification, £1,000 in shares or stock. The first are Messrs. John Galsworthy, F. Tendron, F.C.A., E. J. Woodhouse, W. Needham and J. Fry.

Bell's Asbestos Company (Ld.)

A 22½ per cent. Dividend.—Large growth of business.—Even better prospects for the current year.

The first ordinary general meeting of shareholders was held on Wednesday, 30th ult., at the Cannon street Hotel, London.

Mr. John Bell (the chairman of the company) presiding).

The notice calling the meeting was read by Mr. R. Lander McLaren.

The report and accounts were taken as read.

The Chairman said that when they considered that they had to take stock, and to balance the accounts in two places in Canada, and five places in the United Kingdom, he thought it was creditable especially to the accountant and managing director, and to the staff who had served under him, that the directors were able to meet the shareholders at what they might fairly consider an early date. (Hear, hear.) In alluding to the staff he could not but say, with very great satisfaction, that the zeal which had always distinguished the staff had not abated since the commencement of the company, and every man had done his work as heartily and zealously as in former years before the business was taken over by the company. The manager at Manchester, Mr. Putz, had worked up that branch of the business to a high state of prosperity, and had never worked harder than last year. The manager of every department had been zealous and efficient, and the customers of the company had shown their satisfaction with the work done by continued orders. The continuation of the prosperity they enjoyed was mainly due to the managing director, to whom, although his son, he would say, that to his business capacity and his unceasing labor during many years, and never more than during the past year, the prosperity they enjoyed was in a special sense due. (Cheers.) At first sight the accounts might look somewhat meagre, but when accounts were to be printed and circulated beyond the range of the shareholders, business men could not give those details which they could give in a family circle, because trade rivals would avail themselves of too minute details. (Hear, hear.) Therefore they must not ask for too much detail, but the accounts were not meagre—in the true sense, they showed the true position of the business and its progress. With regard to the share capital, the shares were held by about 230 members, and the money raised by the sale of debenture stock was held by about 100 persons. On the other side of the accounts the bills receivable on hand £3,695, were accepted by firms of undoubted responsibility. The item of "Debtors £35,167," appeared a large item, but it was really one of the healthiest indications of the business. It was really a bank note. Before that figure was put in the accounts all allowances were made, and the discount which had been and has to be allowed had been taken off, and allowed for before the profit was ascertained, and several thousands was the number of people who made it up. The directors could bear with calmness the failure of 1000 persons. On the credit side of the account the figures represented the ordinary purchase of the concern, with the exception of £5,200 unpaid to the vendor. The stock in trade was taken at the exact cost price. They would recollect that it was stated in the prospectus that unsaleable stock was to be eliminated and that stock was to be taken at cost price, and so it stood at the present time. All the stock that was obsolete was taken out and counted for nothing, the rest was real, genuine stock which the company required in its business. The £845 worth of stocks at the asbestos estate in Canada was small. They had only £845 worth of sold but undelivered asbestos when the accounts were made up. The plant, machinery, fittings, fixtures and furniture at London and branches stood at £4,986, which was the exact cost less the amount written off for depreciation during a series of years. In the prospectus it was stated that the machinery and plant were to be taken as they stood in the books of the vendors, subject to an independent valuation to ascertain whether it was fair or not, and the valuers valued it at 40 per cent. above what it was taken over at. (Cheers.) The asbestos estates in Canada stood at the figure they cost, plus the small amount of machinery, and the premises, patents and good will stood at exactly the price paid for them. They could not write anything for depreciation off a property which was

increasing in value, and he believed they could now sell the estates for half as much again as the company gave for them. The directors had made more money for the shareholders than before, they placed to reserve fund £5,000, they retained £9,000 of the profits, which would meet any amount of depreciation they might wish to meet in future times. They would have a big sum by-and-bye from which to take any depreciation. Then he had to refer to a figure which was an agreeable figure, and that was the net profit of £34,421 6s. 9d. In arriving at this profit the stock was taken at the exact cost, and everything which could be written off for bad debts and so on had been done, and every writing down had been done, and this was the genuine and proper profit really and regularly arrived at. In the prospectus the anticipation of a 15 per cent. dividend was held out, but the dividend now proposed was in excess of that figure. But this was not startling to him—it was what he expected and no more. It was the natural outcome of years of labor and thought. This business had been based upon infinite painstaking for many years, and of work which thoroughly considered all the circumstances, and the outcome brought before the shareholder was the natural outcome of careful thought. (Hear, hear.) He had looked forward to this great advance, and he was not surprised at it. The more they looked at it the handsomer it became, and the more important it became. They dealt with many thousands. The business was made up of infinite painstaking in small matters, and they made a small revenue from a constantly extending area. The directors did not wish to startle the shareholders by the announcement of unexpected miracles, but he might say the directors confidently believed that during the year 1889 there would be a very much larger profit than in the year gone by. (Cheers.) With regard to the visit of himself and second son to the property in Canada in February last, he might mention that one object was to see if they could increase the output of asbestos; from the Thetford property alone they could meet the present demand, and payment for a largely increasing dividend from that property alone, and in the meantime the other companies were being brought into working order. The other object of the visit was to examine into the state of the asbestos business in the United States, and see to what extent this company could profitably work part of it. They found that the best way to participate in trade was to supply manufacturers with raw materials as they wanted it. He stated out in Canada that the company would not compete with any manufactured article, but made an arrangement to supply the raw material. Last year he stated that the Canadian property would give a profit of £10,000; the actual figure was £11,000; and the actual profit of the Canadian properties for 1889 would not be a penny less than £10,000. He was sorry to say that Mr. Hartley through failure of health had retired from the board, and in his place the board had elected Mr. R. S. Guinness, of Guinness, Mahon & Co. In conclusion the Chairman moved the adoption of the report and accounts.

Mr. Rhodes Cobb seconded the motion. He said the Chairman had made a most straightforward statement. In the prospectus they were promised 15 per cent.; as a matter of fact they had earned over 30 per cent., of which they had divided 22½ per cent.

The resolution was put and carried.

The Chairman moved a dividend of 15s. per share, payable on the 4th February next.

Mr. Arthur Julian Burnett seconded the motion, which was carried.

The Chairman said that two of the directors retired by rotation, namely Mr. T. B. Lightfoot and A. H. Bell. Those gentlemen had worked well during the year, and offered themselves for re-election.

Mr. Macnair proposed that Mr. Lightfoot be re-elected a director.

Mr. Bird seconded the motion, which was carried.

Mr. W. A. Sparrow moved the re-election of Mr. A. H. Bell as a director. He said he had known Mr. Bell for many years, and knew him to be a most able and capable man. (Hear, hear.)

Mr. Clement seconded the motion, which was carried.

Mr. Elwin proposed the re-election of the auditors, Messrs. Cooper, Brothers & Co., with a remuneration of 50 guineas.

Mr. Clement seconded the motion, which was carried.

A Shareholder proposed a cordial vote of thanks to the directors for the way in which they had conducted the business during the past year, and he would also connect with that the name of Mr. F. C. Bell (managing director), to whom the shareholders owed much of the success of the operations during that time. He had known Mr. Bell for a long time, and he could see nothing but success so long as the management remained in the hands of a gentleman like Mr. Bell. (Cheers.) He congratulated the directors on having secured the services of Mr. Guinness on the board, for that gentleman was one of the most important men in Ireland in regard to his social and political position.

The resolution was seconded and carried.

The proceedings then terminated.

The Relative Importance of the Mining Industry—A Plea for the Gold Miner and His Calling.

[A Paper Read by J. H. TOWNSEND, before the Gold Miner's Association, Halifax, 2nd Feb., 1889.]

Since the day when the fateful mandate went forth, "In the sweat of thy face shalt thou eat bread," the methods by which mankind has sought to provide for his daily sustenance, or to add to his worldly store, have been as varied as have been his needs, real or fancied, in the different degrees of civilization to which he has attained. Amid all the multifarious avocations, the product of the complex civilization of the present age, there stands out prominent before all creative industries the occupation of the miner and the husbandman.

Contrary to the usual custom I place the miner first in a creative sense, because the husbandman calls nature to his aid in that transforming process by which the inutile elements of earth and air are converted into the useful grain and herb, fitted for the best uses of mankind; while the miner by the application of his own brain and brawn brings up from the recesses of the earth the inert ore, releases it from the vice-like grip of its hidden matrix, and converts it into a potent factor in the progress of civilization.

Those intermediary avocations which take the crude products of the mine and farm, and convert them to higher structural forms and make them applicable to more varied uses, add immensely to the sum of the world's comfort and happiness; but it is reserved for the miner and the farmer to add directly to the sum of the world's wealth.

It goes without saying that these two industries lie at the very base and foundation of the social fabric, and furnish the motive power for the continual advancement of the race towards a higher civilization. Whatever may have been the case in those predatory ages of the world's history when might prevailed over right, and brute force was the accepted standard of excellence, it is certain that no race or people have in these later days attained to any exalted position among the nations of the earth unless their social superstructure was underlaid by a great mining or a great agricultural industry. It is only necessary to cite the cases of England and the United States of America in general, and the phenomenal growth of California, Australia and the Cape in particular to establish the correctness of this proposition, while instances are constantly multiplying in our own province of the vivifying effect upon contiguous territory of the prosecution of the mining industry in our midst.

Under these circumstances we should naturally expect to find these two industries held in that high esteem by mankind in general which their importance demands. We would expect to see them fostered and encouraged in every way by statesmen and philanthropists, and that those engaged in them should have so exalted a conception of the dignity of their calling, as to demand and compel the respect of others both for themselves and their industries.

Instead of this happy condition of affairs (to go no further afield than our own province) what do we find to be the case?

Since the publication of the memorable letter of "Agricola," in our early colonial days, there has been a perceptible growth in the appreciation of the business of agriculture, and successive provincial governments have in response to the demands of public opinion, aided in various

ways the dissemination of useful agricultural knowledge, but even in agriculture much remains to be done, and in mining there has yet to be created a healthy public sentiment.

While we have schools of literature, of law, of medicine, of divinity, of art and design, abundantly established and sustained in our midst, schools of agriculture are but in embryo and schools of mines are non-existent; and this, in the very face of the fact that but for the operations of these two industries all others would find their occupation gone, and that in this province the mining industry is the one elastic source from which the Provincial Government may expect a constantly increasing revenue.

The cause of the lack of appreciation of these two great fundamental industries is not far to seek. We can only command that amount of respect from others which we accord to ourselves; true self-respect is the first step necessary towards appreciation by the world.

Farmers and miners as a rule are not proud of their calling, and have no high conception of the value of their work or the relative importance of their industry. The homespun apparel and its hayseed garnishing is regarded by the young men of this generation with a feeling of aversion which is working much ill to themselves and the country, and unhappily the term of "miner" and especially "gold miner" has become, for reasons best known to all of us, a bye-word and reproach.

While these two cognate industries stand in much the same position as regards the strength of their claims for recognition and appreciation, this paper is concerned only with the case of the miner in general and the gold miner in the Province of Nova Scotia in particular.

It is usually easier to discover a want than to suggest a remedy, but in the case of the gold-mining industry in this province there are several schemes which have been attempted or proposed of late, looking to the advancement of the business to a higher status and compelling for it a more enlightened appreciation to which it would be well to advert in this connection.

First* in order of these is the Gold Miner's Club, the offspring of several unsuccessful attempts to establish a general gold-mining association. The Club has now completed the first and most trying year of its existence, has proved itself a potent engine for good, and should commend itself to the enthusiastic support of everyone interested in the industry. It can, if well supported and with honest intent, do much to abolish that stigma of reproach, to remove that aroma of suspicion, under the burden of which the gold industry of the Province has staggered on to its present position and standing. If it becomes, as it ought to become, the recognized exponent of the gold miners of the Province, it can do much to assist wise legislation and to prevent hasty or crude tinkering with the Mining Act.

There is also a comprehensive scheme afloat, which has received the endorsement of the Club, looking to the recognition by the General and Provincial Governments of the importance and value of the mining industry here, by the establishment of an official assay office at Halifax, which would give an impetus to the pioneer work in every branch of mining and would especially relieve the gold industry from many burdens with which it has long been freighted. Those who have this scheme in hand are entitled to and should receive the assistance and moral support of all who properly value the great mining resources of this Province.

There is yet another scheme which has only been mooted, but which needs immediate ven-

lation and development; the establishment of school of mines in embryo.

Amidst all the difficulties against which the old industry of this Province has made a successful struggle, the greatest has been incompetency. Fraud has unquestionably been a large factor in the depreciation of the gold mines of Nova Scotia as in every gold producing country; but for every dollar of capital wasted in this connection ignorance and incompetence are responsible for seventy-five per cent. of the loss.

The importance of the mercantile marine having long been recognized, facilities are provided by means of which any bright young sailor can fit himself for a master or mate's position, thereby elevating himself and increasing the efficiency of the service. It is passing strange that until very lately no such step as this has ever been thought necessary in connection with the great business of mining in this Province. Probably the greatest need that exists to-day in connection with mining generally and gold mining in particular in Nova Scotia, next to the lack of capital, for a fuller development, is the want of honest, intelligent and capable overmen. This is a statement that will be fully concurred in by anyone having experience in the management of mines here during the past ten or fifteen years. Why is it that the young intelligent miner, who having learned the A, B, C, of his calling (how to break rock properly), desiring to fit himself for a higher position finds no avenue open to him, no such facilities provided?

The Government that will provide the means whereby the miner, who has proved himself capable and intelligent, can superadd to the practical knowledge acquired underground a rudimentary knowledge of arithmetic, surveying and mensuration, so that he can keep time, take measurements and estimate quantities, have some idea of mechanics so that he can look after machinery, and so much of geology as will enable him to watch intelligently the constant changes in the formations, will entail upon the Province a lasting debt of gratitude, and will do more to place the business of mining upon a practical and business-like footing than by any other conceivable expenditure.

While these agencies here referred to, which have been attempted or proposed, have in them much power for good to the gold mining industry there is nothing that can so vitally affect the calling for good or ill as the conduct of those directly engaged in it.

"Providence helps those who help themselves," and neither providence nor anyone else will accord to the Gold Mining Guild of this Province an honorable position among provincial industries unless the persons engaged in prosecuting the business are actuated and governed by that code of commercial honor which, in all other callings, furnishes the groundwork for mutual faith and confidence. The Gold Miner's Club has in this respect a great field for usefulness before it, and if it succeeds in establishing a stricter code of mining ethics it will do more than it can in any other way to establish a lasting claim upon the fraternity, and to demonstrate its right to a continued existence.

Haulage in Mines.—At a recent meeting of the Engineers' Club, of Philadelphia, Mr. A. W. Shaefer stated that the cost per ton—mile of haulage in Pennsylvanian anthracite mines was as follows:—

Mules..... 3-64d.
Steam locomotives.... 1-20d.
Electric motors..... 0-80 to 1-34d.

A Visit to a Charcoal Iron Furnace.

(WRITTEN FOR THE REVIEW BY SAM'L D. MILLS, SUPT. MARTEL FURNACE CO., ST. IGNACE, MICH.)

Popular ideas of blast furnace work being generally of a somewhat vague and misty nature, it may interest some of your readers if a plain and simple description of the work at a furnace making charcoal iron is placed before them. The writer had the pleasure of reading a paper upon the subject before the Canadian Institute last year, and this is to some extent a rescript of the same.

The charcoal furnace has been chosen instead of the coke or anthracite furnaces because it is more suited to Canada, and although there are charcoal furnaces to be found where the entire plant as well as the general management are of the crudest possible description, more nicety of arrangement and more exact attention to details is required in this kind of furnace, more especially where "car-wheel iron" is the product sought for, than in either of these.

Let us imagine ourselves visiting a charcoal furnace of the best type, with free permission of the owners to examine all the minutiae of daily work. As we have not time to examine into the mining of the ore, or the manufacture of the charcoal, we will presume that both have been delivered from a distance by rail.

Before entering the Stock-house our attention is directed to the very favourable position of the furnace to railway connection, the contour of the ground being such as to allow the furnaces being placed about 20 feet below the level of the main track, so that the ore cars, by entering the Stock-house that height above the floor, have every facility for "dumping" the ore. On entering we find that there are three parallel tracks, about ten feet apart, traversing the building overhead from end to end, and under these are six large compartments or bins, each of sufficient capacity to hold a six months' supply of the variety of ore for which it is used. The partitions which separate these bins run only part way across the building, leaving a passage of sufficient width to admit a horse and cart for the carriage of the ore from the respective bins to the crushers. The crushers, which are very powerful machines, with a capacity of 50 tons of hard ore per day of 10 hours, are provided with elevator belts which convey the crushed ore up into the ore pockets, from whence it is charged into the ore buggies. These pockets are six in number, and are heavily framed together, forming a hexagonal structure rising about 30 feet above the floor of the Stock-house; the bottom of each pocket is about 9 feet from the floor, and is fitted with a spout having a charging spout at the end worked by a lever which serves to cut off the supply at will. We are next shown the method by which the ore is weighed. We notice that the floor beneath the spouts of the pockets is occupied by a platform scale upon which one of the "stock weighers" has just wheeled an odd looking machine like a bucket on wheels. This buggy is about 2 feet in diameter and 2 ft. 6 inches in depth. Its bottom is formed in the shape of a low cone hanging by its apex to a short perpendicular bar supported by a lever which lifts the cone till it closes the bottom of the buggy, and when necessary allows it to drop again so as to discharge the contents equally all around its circumference. When the bottom is to be kept closed the lever is held tight by a peculiar latch. The stock weigher now proceeds to fill his buggy. He drops the moveable spout beneath one of the pockets and

allows the ore to run till the upper indicator of the scale shows that he has the correct weight. He then drops a latch which releases the next beam of the scale, and repeats the operation from another ore spout, which in its turn is followed by a third, and again by a fourth spout. Then comes a small quantity of limestone and the charge is complete. We observe that there are two more beams to the scale, and are informed that they are not in use at present, as the furnace is running on a mixture of only four ores, though sometimes, we are told, the full set of ore pockets and scale beams are needed. Some of the party having expressed a little curiosity regarding the use of the limestone, as "it will not make any iron," are informed that it is indispensable, as the ores now in use are very pure, but contain some silica (quartz) and alumina, and the addition of the lime causes these substances to melt more easily and form a good fluid slag or cinder, as it is commonly called; also that it has an important influence on the quality of the iron produced and on the working condition of the furnace. We also learn that some ores, being deficient in alumina, require the addition of a little clay (silicate of alumina) to keep the furnace in good working order. If this were neglected the slag would be viscid and "sticky" when hot, and would "build" on to the walls of the furnace, eventually causing scaffolding in the furnace, or, in other words, stopping the descent through it of the mingled ore and fuel, a state of things which is very troublesome for those about the furnace and very unprofitable to the owners. Meanwhile the ore buggy has been wheeled off the scale and round to the hoist or elevator, which takes it up to the top of the furnace. As we have yet to see the charcoal weighed we proceed to the coal-house, next the Stock-house. This building we find to be a mere shed, very lightly framed, and covered only with light sheet iron. In it are standing three box cars, in one of which two men are at work forking the coal on to a large screen, which is so supported as to admit a large sheet iron buggy about 4 feet square and 5 feet in height being run under its end in order to catch the coal as it falls from it. The fine coal and dust (braize, as it is termed) falls through the screen and forms a heap on the floor behind, which is removed from time to time. When this buggy is filled it is taken by the "coal weigher" through the door at the end of the "Stock-house" to the coal scales near the "hoist." Here the weight is adjusted so as to agree with that marked on the beam of the scales, and the car is then run on the "skip" or platform of the elevator. This elevator has two skips, one of which ascends while the other descends. After the loaded buggy has gone up we take our places on the empty skip, and the elevator lands our party safely at the top of the furnace. One of our party immediately exclaims, "But where is the furnace? I don't see any fire," showing that to some of the party a closed top furnace is a novelty. As soon as the charge in the "hopper" has been lowered and the gas has cleared off we step forward to take a look at the fittings by which the charging is accomplished, and looking down into the furnace perceive that it is closed by a circular iron "hopper," with a conical bell in the centre, exactly like the cone in the iron ore buggy, only a great deal larger, and worked in a similar way, except that it has two heavy iron rods to hold it up, and the great cast-iron beam which takes the place of the lever on the buggy requires a powerful winch to move it. We now begin to understand some-

thing of the *modus operandi*, and stepping back we watch the filling in of the next charge. First of all a buggy of ore which has just come up is run over the mouth of the "hopper," the wheels of the buggy straddling the opening. The "top-filler" takes care to get it centred exactly, so that the apex of the buggy cone is perpendicularly over that of the furnace cone. He then releases the lever of the buggy and the ore falls down very evenly all round. Then another buggy of ore goes in in like manner, followed by two buggies of coal, the latter are carefully levelled, and then the cover or "seal," (a heavy cast iron lid) is let down over the hole. The "top filler," having ascertained that there is room for another charge (he does this by means of a light iron rod which he passes down into the furnace through a hole in the iron plate surrounding the mouth of the cover), gives the handle of the winch a couple of turns, then reverses it, raising the "bell" or cone again, and the hopper is ready for another charge. On learning that it is near time for casting we descend and proceed to the Casting-house. We have, however, a little time to spare before this operation begins, and decide to "take in" the bottom of the furnace, blowing engine, etc. The engine-house is a substantial brick structure about 30 x 35 feet and 30 feet high, surmounted by an iron tank 5 feet deep and the full size of the building. Here we find the blowing engine and a small engine used for driving the crushers, laths and other plant in the machine shops, also two powerful steam pumps. The blowing engine is of the upright type, with the steam cylinder directly under the air cylinder—the former being about 32" diameter, the latter about 72"; the stroke about 48", delivering 226 cubic feet of air to the furnace at each revolution. We then pass out and note the direction the wind pipe takes to the "ovens," and on our way back pass through the boiler house. Here there are six tubular boilers, 4 feet in diameter by 35 feet in length, set in pairs, one furnace heating two boilers. Only four of these are in use at present, the others being held in reserve in case of repairs being needed upon any of those in use. They are also "changed off" from time to time to permit them being thoroughly cleaned and "scaled." There is but little solid fuel used, as the gases from the furnace are generally more than sufficient for all requirements. The wind-pipe passes behind a lofty cylindrical structure, composed externally of large sheets of boiler plate rivetted together, forming a sort of tower, probably 15 feet in diameter and 60 feet in height. This stood rather to the rear of the furnace and next to the elevator, on the other side of which was another of the same construction, the wind-pipe being carried on behind it also, and connected with a branch pipe. We were shown the valves at the rear by which the wind or "blast" can be shut off. There was also an outlet leading from the bottom of the wind-pipe (also with a valve) where it turned into the "oven" and down into a flue communicating with the large draught stack. This stack was a fine structure, about 12 feet in diameter at the base and over 150 feet in height. Passing round to the side of the "oven" nearest to the "stack," as the furnace itself is generally called, we found a similar branch pipe with the upper part connected with a large pipe which ran completely round the furnace. This and the branch from it to the oven were much larger than the blast pipe on the other side of the oven. The downward portion of the branch had also a valve connected with the "gas flue," leading underground from the "down corner" (a large pipe

extending from the side of the furnace near the top down to the ground, at about 10 feet from the side of the furnace, which serves to lead the gas from the top of the furnace down to the underground flues, by which it is then led off to supply the boiler furnaces and three ovens.) In answer to an enquiry how and why it was used to heat the ovens, we were informed that on opening the valve leading up from the gas flue, and also that leading down to the draught stack flue—the other two valves to the "stack" and those from the blast pipe being first closed—the gas passes into the oven, and coming into contact with the heated brickwork inside takes fire and burns with an intensely hot flame. The ovens are lined with fire-brick, and the space is sub-divided into perpendicular flues, so arranged that the flame, and intensely heated gases resulting from the combustion of the furnace gas, have to pass up and down twice the entire height of the oven before finding their way out past the valve to the draught stack. This is allowed to continue for two hours, then the gas is shut off; the valve leading to the pipe round the furnace (the "bustle" pipe) and also that leading from the blast pipe are opened; the blast passes in at the back of the oven and up and down through the now intensely hot flues, and then passes into the "bustle" pipe at a temperature of 1200° F., or up to 1800° F. if so desired; it then passes in the opposite direction to that followed by the gas, so that it leaves the oven at the hottest point. On reaching the "bustle-pipe" the blast passes from it down through branch pipes ("belly pipes") to the "tuyeres," and by them into the furnace. The connections from the "oven" to the "bustle pipe" and the "belly pipes" are all lined with fire-brick to enable them to withstand the tremendous heat to which they are exposed. The ovens are used alternately—one heating while the other is in use.

One of our party having enquired how it was that there was any combustible gas given off by the furnace, the action was described to be of the following nature:—The ore, in passing down through the furnace, undergoes two separate and successive changes, viz., reduction and then fusion. All iron ores—that is, all ores used for the production of iron—consist of combinations of iron with oxygen. Associated with these oxides of iron there are a great number of other substances, notably silica, alumina, lime, magnesia, sulphur, phosphorus, etc., all combined with each other, or with a small amount of iron. With the exception of the lime, which frequently occurs as carbonate, and the silica, which often occurs as free silica or quartz, it has been proved that the reduction, or the separation of the iron from the oxygen, takes place at a temperature far below that required for the fusion either of the iron or of any of the combinations of the associated bodies. Simultaneously with the reduction another action takes place, viz., carbonization or absorption of carbon by the ore. This mysterious action, by which the carbon is absorbed and fixed in the pores of the ore, so as to disintegrate it, much in the same manner in which frost disintegrates soft brick that has formerly been moistened, can only take place in an atmosphere of gas containing carbon, mon-oxide (C.O.), in the proportion of two or more parts to 1 of carbonic acid (C.O₂); reduction also requires the same condition. This action commences almost immediately after the ore has been placed in the furnace, although the temperature at the top immediately under the "bell" is not more than 350° to 400° F. In order to understand this clearly it is best to take first into consideration the

action at the "tuyeres," and follow the gas in their passage upward through the mass of ore and fuel. At the "tuyeres" we have the air blown in at a temperature of say 1200° F. composed of about 23 parts of oxygen to 77 of nitrogen by weight, leaving out the small quantity of carbonic acid and moisture always present. The nitrogen may be regarded as inert as it merely carries in 1200° F. of heat, leaves 800° F. to be utilized, and passes off unchanged at 400° F. The oxygen attacks the highly heated fuel, burns it, forming carbonic acid which is again immediately reduced to carbon mon-oxide as it passes up through the heated charcoal. Owing to the constant addition of fresh supplies of cold ore and fuel the furnace is naturally colder towards the top, so this carbon mon-oxide (C.O.) gas passes up unchanged until it reaches a point in the furnace where the temperature is so low that carbonic acid (C.O₂) cannot be decomposed by the carbon in the charcoal. But, as we have already seen, the action of the carbon mon-oxide on the ore still continues, so that the ore absorbs some of the carbon (C.) from the C.O., so forming some C.O₂, and at the same time giving up its oxygen to combine with some more of the C.O., making more C.O₂. This action can continue until the proportion of C.O₂ to C.O. is about as 1:2, after which it appears to cease. Now, as you know that carbon mon-oxide burns with great evolution of heat, you can understand how we heat our stoves and boilers by utilizing the waste gasses that in former days were allowed to escape unheeded.

(To be continued.)

NOTICE.

Tenders will be received by the Department of Inland Revenue until

MONDAY, the 4th March, proximo,

From parties desirous of leasing the privilege of

FERRYING ACROSS THE OTTAWA RIVER

BETWEEN

ST. THOMAS D'ALFRED IN THE COUNTY OF PRESCOTT, PROVINCE OF ONTARIO, AND DOMINION OF CANADA,

AND

MONTEBELLO, IN THE COUNTY OF OTTAWA, PROVINCE OF QUEBEC, AND DOMINION OF CANADA,

In accordance with the terms and under the conditions set forth in the regulation, copies of which can be obtained at the Department of Inland Revenue, Ottawa.

Each tender must state the amount the party tendering is willing to pay per annum for the privilege referred to, which amount will be paid in advance, the term of lease being for five years, from the 1st day of May, 1889.

Each tender must be accompanied by a cheque marked "good" on one of the chartered banks doing business at Ottawa, or by Dominion currency to one-half the amount of the per annum tender. This amount will be credited on account of the first years rent in the case of the accepted tender, and all other cheques or moneys will be returned, except in the event of withdrawal, in which cases no refund will be made.

All communications must be addressed to the Commissioner of Inland Revenue and endorsed on the envelope "Tender for Montebello Ferry."

Any newspaper inserting this notice without first obtaining the authority of this Department will not receive payment therefor.

By order,

WM. HIMSWORTH,
Secretary.

Department of Inland Revenue, 1
Ottawa, 11th of Feb., 1889.



SEALED TENDERS, addressed to the undersigned, and endorsed "Tender for Ice, Public Buildings," will be received at this office until Thursday, the 28th inst., for filling the Government ice house at the Rideau Canal Basin, Ottawa.

Sealed Tenders, endorsed "Tender for Ice, Rideau Hall, &c., will also be received at the same time for filling the ice house at the Governor-General's Residence, Rideau Hall.

Tender to state price per block of the following dimensions: viz.,—3 ft. by 1 ft. by 1 ft., which price must include cost of packing and of the sawdust required for that purpose.

All sawdust on premises to be removed; only new sawdust to be used.

The ice to be measured before being packed in the ice house and payment to be made accordingly.

N.B.—The ice must be taken from above the Railway Bridge, crossing the Ottawa River above Chaudiere Falls.

By order,

A. GOBELL,
Secretary,

Department of Public Works,
Ottawa, 16th Feb., 1889.

88, 90, 92, 94 Rideau, 15 to 23 Mosgrove
and 186 Sparks Sts.

S. & H. BORBRIDGE,
Manufacturers of

Saddles, Harness, Trunks, Valises, Bags,
Satchels, Horse-Blankets, Beef and Oil-
Tanned Moccasins.

OTTAWA.

VALUABLE PLUMBAGO

AND OTHER

Mineral Lands FOR SALE,

IN THE TOWNSHIP OF BUCK-
INGHAM, COUNTY OF
OTTAWA.

1st.—Lot 28, in the 6th range, containing 100 acres, in addition to the salina of the lake.

2nd.—North half of lot 23, in the 5th range, containing 100 acres.

3rd.—Nine acres of lot No. 28, in the 5th range, with water privileges thereto appertaining, being site of mill dam, etc., etc.

The property formerly belonged to the Montreal Plumbago Mining Company, and was worked successfully for several years, until the company's mill was destroyed by fire, but the mill dam remains almost uninjured, and there are on the property several houses, sheds, etc., built for various purposes when mining operations were carried out.

The Plumbago Deposits

upon the property are regarded as amongst the richest and most extensive in the Dominion. As to the quality of the Plumbago, it has been extensively used in the manufacture of crucibles, lubricating leads, stove polish, etc., etc., and given unbounded satisfaction. This is established by the experience of consumers, and by a certificate from the celebrated Battersea Crucible Works, London, England, a copy of which is open for inspection.

MICA

has also been discovered in quantity.

The lands are in the Phosphate region, and recent prospecting has disclosed a rich and extensive deposit of this mineral. There are unrivalled facilities for transporting the ore to and from the mines by the Ottawa River and C. P. Railway. Distance from mines to Railway Station 6 miles. Good road.

All that is required to make these valuable mines handsomely remunerative is a little capital and enterprise.

The Title is Indisputable.

For information apply to

WM. H. DICKSON,
160 Waller St., Ottawa.

H. E. DICKSON,
Russell House, Ottawa.

OR TO THE OFFICE OF

THE CANADIAN MINING REVIEW
OTTAWA.

By Royal  Letters Patent.

The Perfection Smoke Consumer & Fuel Economizer.

FOR ALL HORIZONTAL BOILERS, STATIONARY AND MARINE.

At City Waterworks (Wheelhouse), C.P.R. Works and Canadian Rubber Co., Montreal

Users of Lancashire, Cornish, and other flued boilers, invited to correspond.
Improved method of setting for new and existing boilers.

**Dobson & Brodie, - - 169 St. James St.,
MONTREAL.**



**JOHN A. ROEBLING'S SONS CO.
WIRE ROPE**

—FOR—

Mines, Elevators, Inclines, &c.

GALVANIZED GUY ROPE. BRIDGE CABLES.
HAWSER ROPES.

WIRE of all kinds. Insulated WIRES

John A. Roebling's Sons Co.

117 & 119 LIBERTY St., NEW YORK.

H. L. SHIPPY Sec'y.



DEPARTMENT

OF

Inland Revenue.

An Act Respecting Agricultural Fertilizers.

The public is hereby notified that the provisions of the Act respecting AGRICULTURAL FERTILIZERS came into force on the 1st of January, 1886 and that all Fertilizers sold thereafter require to be sold subject to the conditions and restrictions therein contained—the main features of which are as follows:

The expression "fertilizer" means and includes all fertilizers which are sold at more than TEN DOLLARS per ton, and which contains ammonia, or its equivalent of nitrogen, or phosphoric acid.

Every manufacturer or importer of fertilizers for sale, shall, in the course of the month of January in each year, and

before offering the same fertilizer for sale, transmit to the Minister of Inland Revenue, carriage paid, a sealed glass jar, containing at least two pounds of the fertilizer manufactured or imported by him, with the certificate of analysis of the same, together with an affidavit setting forth that each jar contains a fair average sample of the fertilizer manufactured or imported by him; and such sample shall be preserved by the Minister of Inland Revenue for the purpose of comparison with any sample of fertilizer which is obtained in the course of the twelve months then next ensuing from such manufacturer or importer, or collected under the provisions of the Adulteration Act, or is transmitted to the chief analyst for analysis.

If the fertilizer is put up in packages, every such package intended for sale or distribution within Canada shall have the manufacturer's certificate of analysis placed upon or securely attached to each package by the manufacturer; if the fertilizer is in bags it shall be distinctly stamped or printed upon each bag; if it is in barrels, it shall be either branded, stamped or printed upon the head of each barrel or distinctly printed upon good paper and securely pasted upon the head of each barrel, or upon a tag securely attached to the head of each barrel; if it is in bulk, the manufacturer's certificate shall be produced and a copy given to each purchaser.

No fertilizer shall be sold or offered or exposed for sale unless a certificate of analysis and sample of the same shall have been transmitted to the Minister of Inland Revenue and the provisions of the foregoing sub-section have been complied with.

Every person who sells or offers or exposes for sale any fertilizer, in respect of which the provisions of this Act have not been complied with—or who permits

a certificate of analysis to be attached to any package, bag or barrel of such fertilizer, or to be produced to the inspectors to accompany the bill of inspection of such inspector, stating that the fertilizer contains a larger percentage of the constituents mentioned in sub-section No. 11 of the Act than is contained therein—or who sells, offers or exposes for sale any fertilizer purporting to have been inspected, and which does not contain the percentage of constituents mentioned in the next preceding section—or who sells or offers or exposes for sale any fertilizer which does not contain the percentage of constituents mentioned in the manufacturer's certificate accompanying the same, shall be liable in each case to a penalty not exceeding fifty dollars for the first offence, and for each subsequent offence to a penalty not exceeding one hundred dollars. Provided always that deficiency of one per centum of the ammonia, or its equivalent of nitrogen, or of the phosphoric acid, claimed to be contained, shall not be considered as evidence of fraudulent intent.

The Act passed in the forty-seventh year of Her Majesty's reign, chaptered thirty-seven and entitled, "An Act to prevent fraud in the manufacture and sale of agricultural fertilizers," is by this Act repealed, except in regard to any offence committed against it or any prosecution or other act commenced and not concluded or completed, and any payment of money due in respect of any provision thereof.

A copy of the Act may be obtained upon application to the Department of Inland Revenue, as well as a copy of a Bulletin which it is proposed to issue in April, 1888, concerning the fertilizers

E. MIALL,
Commissioner.

January, 1889.



THE

Intercolonial Railway

OF CANADA.

The Royal Mail Passenger & Freight
Route between Canada and
Great Britain,

—AND—

Direct route between the West and all points on the Lower St. Lawrence and Baie des Chaleurs; also New Brunswick, Nova Scotia, Prince Edward Island, Cape Breton and Newfoundland.

New and Elegant Buffet Sleeping and Day Cars run on through Express Trains.

Passengers for Great Britain or the Continent by leaving Toronto by 8 00 A.M. train Thursday will join Outward Mail Steamer at Halifax Saturday.

Superior Elevator, Warehouse and Dock accommodation at Halifax for shipment of grain and general merchandise.

Years of experience have proved the Intercolonial, in connection with steamship lines to and from London, Liverpool and Glasgow to Halifax, to be the quickest freight route between Canada and Great Britain.

Information as to Passenger and Freight rates can be had on application to

E. KING,
27 Sparks Street,
OTTAWA.

G. W. ROBINSON,
Eastern Passenger Freight Agent,
137½ St. James St., MONTREAL.

D. POTTINGER,
Chief Superintendent.

Railway Offices, Moncton, N.B.
Nov. 20th, 1888.

The Polson Iron Works Co'y

TORONTO, ONT.

Manufacturers of the Celebrated "Brown Automatic Engine."

GENERAL DEALERS IN

MINING MACHINERY.

SPECIAL AGENTS FOR

Knowles' Steam Pumps,

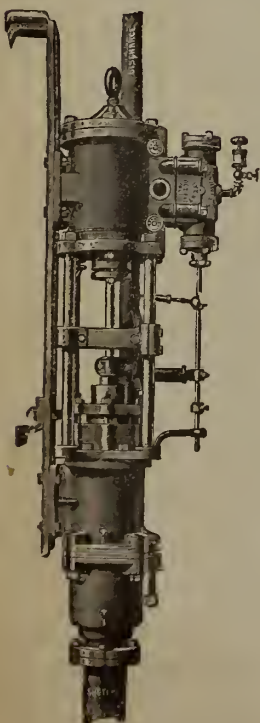
B. T. Sturtevant's Blowers and Fans,

Burleigh Rock Drills.

Hoisting Engines and Boilers, Quartz Mills, Diamond Prospecting Drills, Rock Breakers.

Office and Works, Esplanade E.; Warehouse, 38 Yonge St.,

TORONTO.

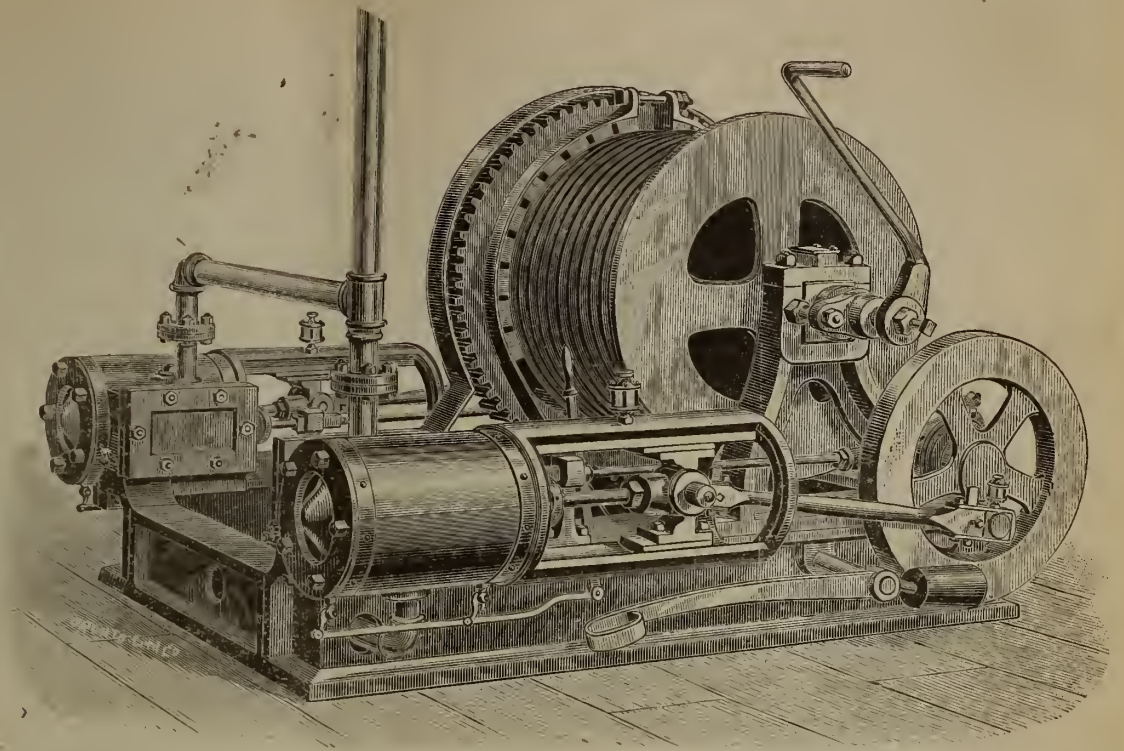


JOHN DOTY ENGINE CO.

Toronto, Ont.

MANUFACTURERS OF

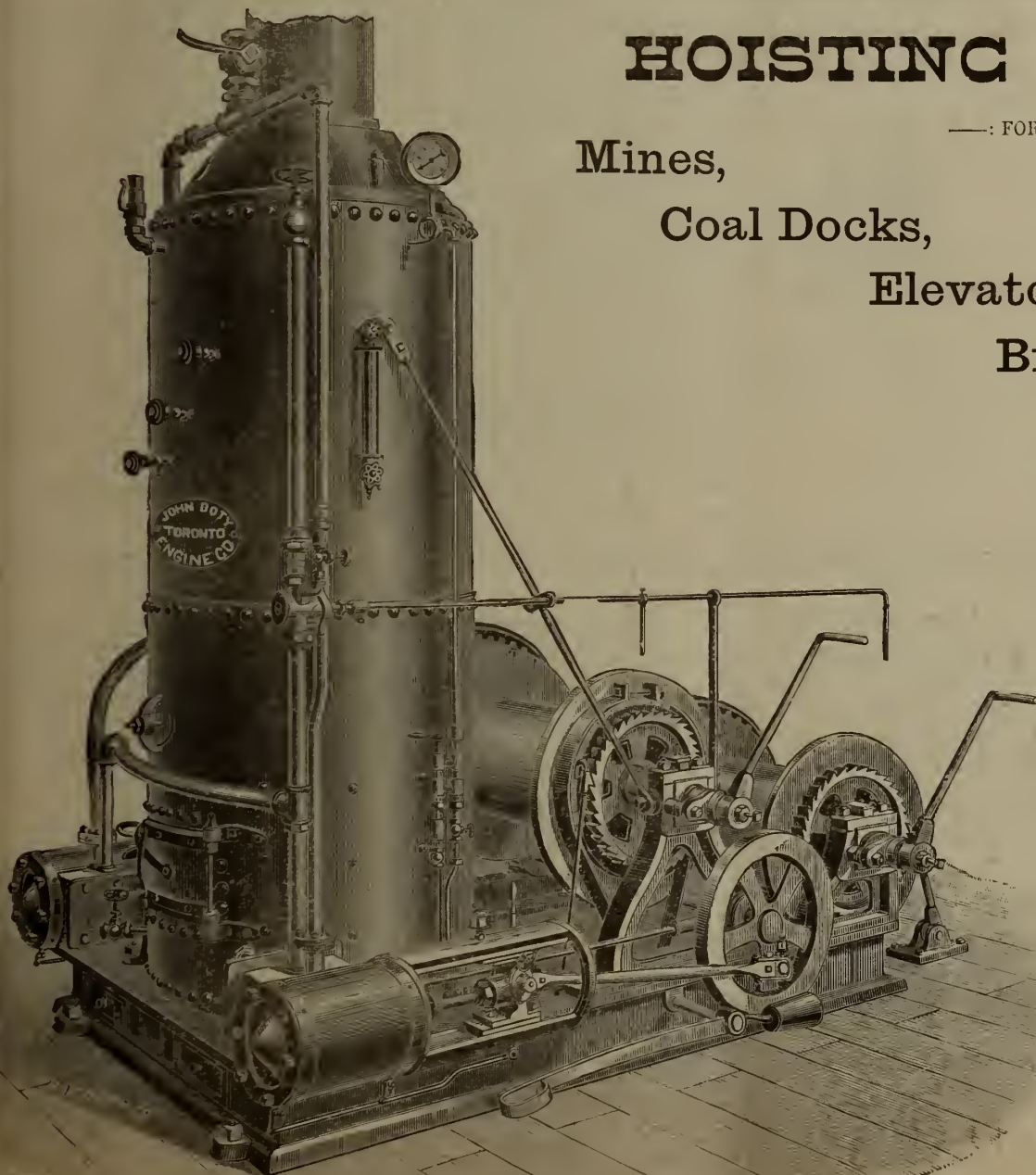
Mining & General
Machinery.



HOISTING ENGINES

—: FOR :—

Mines,
Coal Docks,
Elevators,
Bridge Builders,
Contractors, &c.



CORLISS ENGINES

Tug & Steam Yacht Engines,
Mill Engines.

Shafting & Mill
Gearing.

All Descriptions of Boiler
and Tank Work.

Send for Estimates and
Catalogues.

RUSSELL & CO.

PROVINCIAL AND DOMINION
LAND SURVEYORS,
CIVIL AND MINING ENGINEERS,
PORT ARTHUR, ONTARIO.

Mining Properties Surveyed, Reported on and Dealt in.

Latest and Most Complete Plans of Thunder Bay
Mining District Always on Hand.

A. L. RUSSELL, A. H. MACDOUGLL, W. W. RUSSELL.
P. L. S., D. L. S. P. L. S., D. L. S. M.E.A.MCAN.SOC.C.E.

FOR SALE.

Asbestos Mines.

On Lots 27, 28 and 29, in Range A, of Colrairie,
Megantic County, P. Q.

300 ACRES,

One Mile from Quebec Central Railway.

Free from Reserves or Royalties.

James Reed,

Reedsdale, Megantic, P. Q.



MONEY ORDERS.

MONEY ORDERS may be obtained at any
Money Order Office in Canada, payable in
the Dominion; also in the United States, the United
Kingdom, France, Germany, Italy, Belgium,
Switzerland, Sweden, Norway, Denmark, the
Netherlands, India, the Australian Colonies, and
other countries and British Colonies generally.

On Money Orders payable within Canada the
commission is as follows:

If not exceeding \$4.....	2c.
Over \$4, not exceeding \$10.....	5c.
" 10, " " " 20.....	10c.
" 20, " " " 40.....	20c.
" 40, " " " 60.....	30c.
" 60, " " " 80.....	40c.
" 80, " " " 100.....	50c.

On Money Orders payable abroad the commis-
sion is:

If not exceeding \$10.....	10c.
Over \$10, not exceeding \$20.....	20c.
" 20, " " " 30.....	30c.
" 30, " " " 40.....	40c.
" 40, " " " 50.....	50c.

For further information see OFFICIAL POSTAL
GUIDE.

Post Office Department, Ottawa.
15th Sept., 1888.

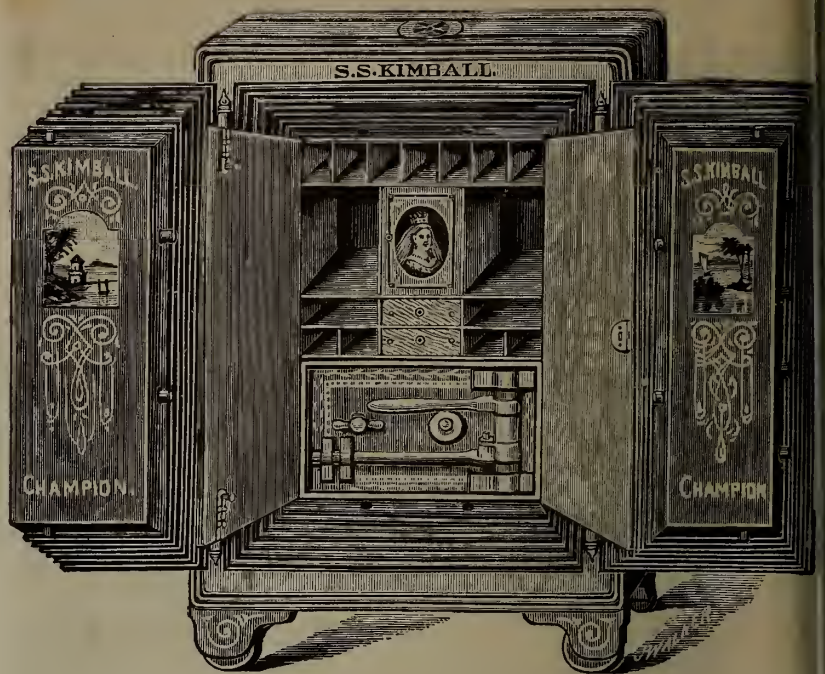
Champion Fire and Burglarproof Safes.

These Safes have the best record of any in the Dominion. Price 30
per cent. cheaper than any other first-class Safe.

SEND FOR CATALOGUE AND PRICE-LIST.

S. S. KIMBALL,

577 Craig St., Montreal.



Van Duzen Steam Jet Pump.

MINING.—Our \$16 Pump preferred to a \$200 Steam Pump.

STATE OF MAINE ASSAY OFFICE,
F. L. BARTLETT,
PORTLAND, ME., June 21, 1883.



"GENTLEMEN,—The No. 5 'L' (\$16) Steam Jet Pump I purchased of you I have
used for raising water from a mining shaft fifty feet deep. I set it to draught twelve and force
thirty eight feet. It worked very well indeed, although I was obliged to carry steam 150 feet
from the boilers and in weather often below zero. I carried 75 pounds of steam at the boiler,
and the Jet Pump took the place of a No. 3 K (\$200 Piston Pump), that I had to remove.

"Yours truly,

F. L. BARTLETT."

Address for further particulars,

CARTH & CO.,

MONTREAL



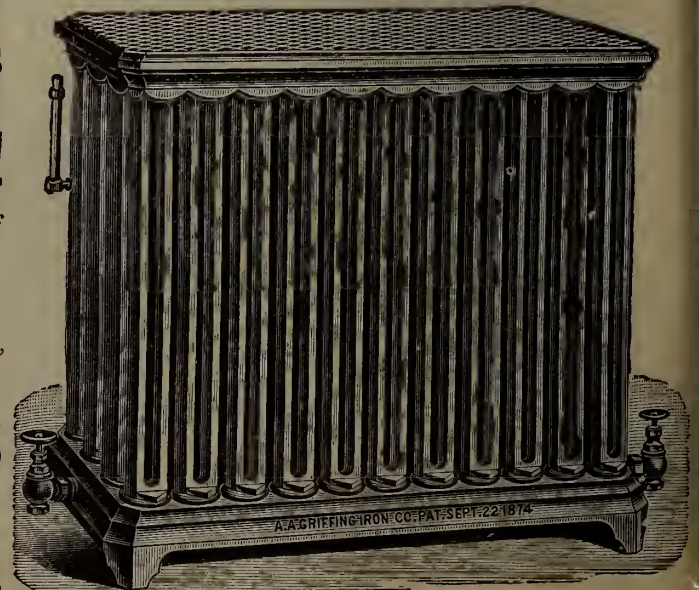
USE GURNEY'S IMPROVED CELEBRATED Hot Water Heaters!

Guaranteed more Economical than any other
Heater now made, and containing every
known Improvement in Hot
Water Heating.

STEAM FITTINGS, CAST IRON PIPE,
REGISTER, GRATES, ETC.

HOT AIR FURNACES FOR COAL OR WOOD.

E. & C. GURNEY & CO., MONTREAL.



Bundy Radiators for Quick Circulation and Economy of Space.



Mining Regulations

TO GOVERN THE DISPOSAL OF

Mineral Lands other than Coal Lands, 1886.

THESE REGULATIONS shall be applicable to all Dominion Lands containing gold, silver, cinnabar, lead, tin, copper, petroleum, iron or other mineral deposits of economic value, with the exception of coal.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein, either by surface or subterranean prospecting for mineral deposits, with a view to obtaining under the Regulations a mining location for the same, but no mining location or mining claim shall be granted until the discovery of the vein, lode or deposit of mineral or metal within the limits of the location or claim.

QUARTZ MINING.

A location for mining, except for iron on veins, lodes or ledges of quartz or other rock in place, shall not exceed forty acres in area. Its length shall not be more than three times its breadth, and its surface boundary shall be four straight lines, the opposite sides of which shall be parallel, except where prior locations would prevent, in which case it may be of such a shape as may be approved of by the Superintendent of Mining.

Any person having discovered a mineral deposit may obtain a mining location therefor, in the manner set forth in the Regulations which provides for the character of the survey and the marks necessary to designate the location on the ground.

When the location has been marked conformably to the requirements of the Regulations, the claimant shall within sixty days thereafter, file with the local agent in the Dominion Land Office for the district in which the location is situated, a declaration or oath setting forth the circumstances of his discovery, and describing, as nearly as may be, the locality and dimensions of the claim marked out by him as aforesaid; and shall, along with such declaration, pay to the said agent an entry fee of FIVE DOLLARS. The agent's receipt for such fee will be the claimant's authority to enter into possession of the location applied for.

At any time before the expiration of FIVE years from the date of his obtaining the agent's receipt it shall be open to the claimant to purchase the location on filing with the local agent proof that he has expended not less than FIVE HUNDRED DOLLARS in actual mining operations on the same; but the claimant is required, before the expiration of each of the five years, to prove that he has performed not less than ONE HUNDRED DOLLARS' worth of labor during the year in the actual development of his claim, and at the same time obtain a renewal of his location receipt, for which he is required to pay a fee of FIVE DOLLARS.

The price to be paid for a mining location shall be at the rate of FIVE DOLLARS PER ACRE, cash, and the sum of FIFTY DOLLARS extra for the survey of the same.

No more than one mining location shall be granted to any individual claimant upon the same lode or vein.

IRON.

The Minister of the Interior may grant a location for the mining of iron, not exceeding 160 acres in area which shall be bounded by north and south and east and west lines astronomically, and its breadth shall equal its length. Provided that should any person making an application purporting to be for the purpose of

mining iron thus obtain, whether in good faith or fraudulently, possession of a valuable mineral deposit other than iron, his right in such deposit shall be restricted to the area prescribed by the Regulations for other minerals, and the rest of the location shall revert to the Crown for such disposition as the Minister may direct.

The regulations also provide for the manner in which land may be acquired for milling purposes, reduction works or other works incidental to mining operations.

Locations taken up prior to this date may, until the 1st of August, 1886, be re-marked and re-entered in conformity with the Regulations without payment of new fees in cases where no existing interests would thereby be prejudicially affected.

PLACER MINING.

The Regulations laid down in respect to quartz mining shall be applicable to placer mining as far as they relate to entries, entry fees, assignments, marking of localities, agents' receipts, and generally where they can be applied.

The nature and size of placer mining claims are provided for in the Regulations, including bar, dry, bench, creek or hill diggings, and the RIGHTS AND DUTIES OF MINERS are fully set forth.

The Regulations apply also to

BED-ROCK FLUMES, DRAINAGE OF MINES AND DITCHES.

The GENERAL PROVISIONS of the Regulations include the interpretation of expressions used therein; how disputes shall be heard and adjudicated upon; under what circumstances miners shall be entitled to absent themselves from their locations or diggings, etc., etc.

THE SCHEDULE OF MINING REGULATIONS

Contains the forms to be observed in the drawing up of all documents such as:— "Application and affidavit of discoverer of quartz mine." "Receipt for fee paid by applicant for mining location." "Receipt for fee on extension of time for purchase of a mining location." "Patent of a mining location." "Certificate of the assignment of a mining location." "Application for grant for placer mining and affidavit of applicant." "Grant for placer mining." "Certificate of the assignment of a placer mining claim." "Grant to a bed rock flume company." "Grant for drainage." "Grant of right to divert water and construct ditches."

Since the publication, in 1884, of the Mining Regulations to govern the disposal of Dominion Mineral Lands the same have been carefully and thoroughly revised with a view to ensure ample protection to the public interests, and at the same time to encourage the prospector and miner in order that the mineral resources may be made valuable by development.

COPIES OF THE REGULATIONS MAY BE OBTAINED UPON APPLICATION TO THE DEPARTMENT OF THE INTERIOR.

A. M. BURGESS,

Deputy Minister of the Interior.

TORONTO BAG WORKS

MANUFACTURERS OF

BAGS for ORES, PHOSPHATES, ETC.,

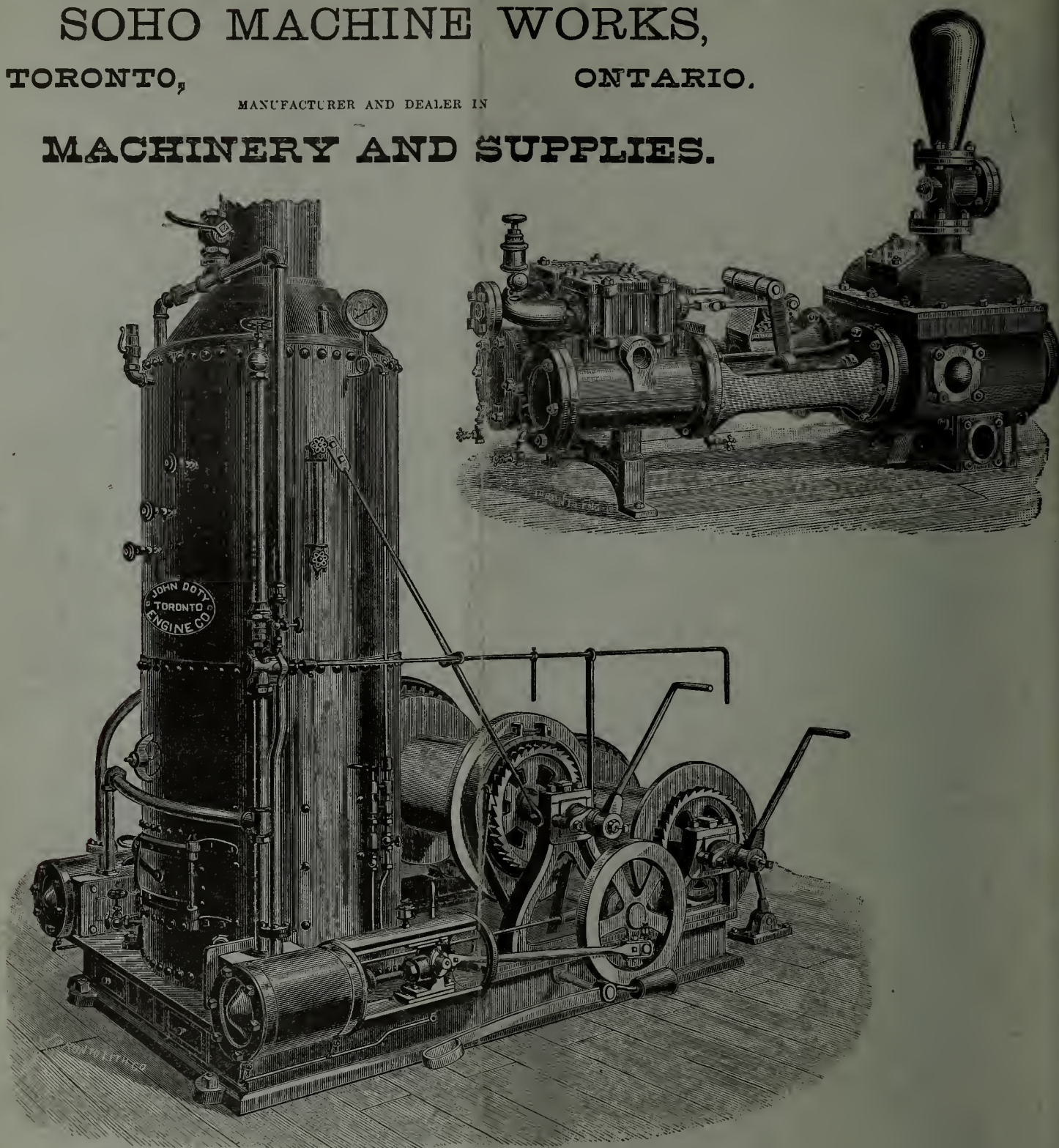
AND FOR ALL OTHER PURPOSES.

DICK, RIDOUT & CO.,

11 and 13 Front St. East,

TORONTO.

A. R. WILLIAMS,
SOHO MACHINE WORKS,
TORONTO, ONTARIO.
MANUFACTURER AND DEALER IN
MACHINERY AND SUPPLIES.



Duplex Steam Pumps, all sizes. Every Pump Guaranteed.

VERY LOW PRICES.

Portable Engines, Hoisting Engines, Stationary Engines, Iron and Wood Working Machinery, Ventilating Fans, Saw Mill and Shingle Mill Machinery. Full lines of Machinery and Supplies. Send for Catalogue.

MINING REVIEW

Canadian

Established 1882

Vol. VIII.—No. 3.

1889.—OTTAWA, MARCH—1889.

Vol. VIII.—No. 3

THE STANDARD AMERICAN ROCK DRILLING
and AIR COMPRESSING MACHINERY.

WRITE TO US.

ROCK DRILLS
AIR COMPRESSORS &
GENERAL MACHINERY FOR
MINING, TUNNELING,
QUARRY & RAILROAD WORK
RAND DRILL CO 23 PARK PLACE, NEW YORK

SEND FOR CATALOGUE.

The Highest American Tunneling Record.

Hamilton Powder

COMPANY,

Manufacture Mining, Blasting, Military
and Sporting

Gunpowder,

DYNAMITE, DAULIN, and the new

ECLIPSE MINING POWDER

DOMINION AGENTS FOR

Safety Fuse, Electric Blasting
Apparatus, &c.

OFFICE

103 ST. FRANCOIS XAVIER STREET
MONTREAL.

BRANCH OFFICES & MAGAZINES
at all chief distributing points
in Canada.

CANADA ATLANTIC
RAILWAY.

THE SHORTEST PASSENGER ROUTE
BETWEEN

Ottawa and Montreal,
AND ALL POINTS EAST & SOUTH.

The only road in Canada running trains lighted
with electricity and heated by steam from the
engine. Luxurious Buffet Pullman Palace Cars
on all trains between Ottawa and Montreal. Only
line running through Sleeping Cars between

Ottawa, Boston and New York

And all New England and New York points.

Baggage checked to all points and passed by Cust-
oms in transit.

During season of navigation close connections
are made with Richelieu and Ontario Navigation
Company's Steamers at Coteau Landing, shooting
the St. Lawrence Rapids.

For Tickets, Time Tables and information apply
to nearest agent, or to

S. EBBS, City Passenger Agent,
24 Sparks St., OTTAWA.

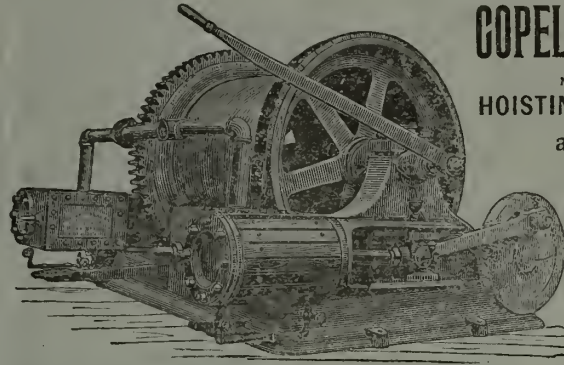
GEO. H. PHILLIPS, Gen. Agent,
VALLEYFIELD.

A. E. CAIRNS, General Agent,
136 St. James St., MONTREAL.

Or at 260 Washington St., Boston, and
317 Broadway, New York.

PERCY R. TODD,
General Passenger Agent.

E. J. CHAMBERLIN,
General Manager,
General Offices, Ottawa.



COPELAND & BACON

MANUFACTURERS OF
HOISTING ENGINES,
and MINING PLANTS.

85 Liberty St.
NEW YORK.

Send for Catalogue.

MILLER BROS. & MITCHELL

MANUFACTURERS OF

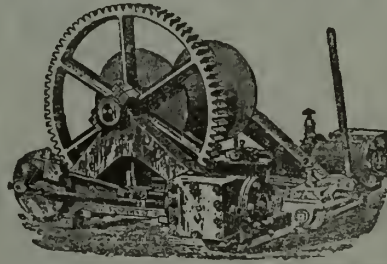
Steam Rock Drills

AND

HOISTING ENGINES,

Mining & Contractors' Plant
&c., &c.

110 TO 120 KING STREET, MONTREAL, QUE.



THE

BELL TELEPHONE CO.

OF CANADA.

ANDREW ROBERTSON, . . . PRESIDENT

C. F. SISE, . . . VICE-PRESIDENT

C. P. SCLATER, . . . SECRETARY-TREASURER

HEAD OFFICE, . . . MONTREAL.

H. C. BAKER, Manager Ontario Department,
HAMILTON.

This Company will sell its instruments at prices
ranging from \$10 to \$25 per set. These instru-
ments are under the protection of the Company's
patents, and purchasers are therefore entirely free
from risk of litigation.

This Company will arrange to connect places
not having telegraphic facilities with the nearest
telegraph office, or it will build private lines for
firms or individuals, connecting their places of
business or residences. It is also prepared to
manufacture all kinds of electrical apparatus.

Full particulars can be obtained the at Com-
pany's offices as above, or at St. John, N.B., Hal-
ifax, N.S., Winnipeg, Man., Victoria, B.C.



MISS M. E. ORR.

REMINGTON

STANDARD

TYPEWRITER

Miss Orr, Championship
of the world and Gold Medal
at Toronto, 13th August,
1888.

GEORGE BENGOUGH,

GENERAL AGENT,

36 King Street, TORONTO.

ALEX. FLECK, JUN.,

Manufacturer of every Description of

Mill Machinery

Water Wheels, Steam Engines,
Boilers, Derricks, Steam
Pumps and Mining
Machinery.

Brass and Iron Casting of every
Description.

VULCAN IRON WORKS, WELLINGTON ST
OTTAWA.

DYNAMO ELECTRIC

MACHINES and LAMPS



THE
BALL ELECTRIC LIGHT CO. LD.
MANUFACTURERS OF

ELECTRIC LIGHTING APPARATUS
57, ADELAIDE ST. W.
TORONTO
ONT.

ARC and INCANDESCENT

FOR MINING PURPOSES

THE CANADIAN RUBBER CO.
OF MONTREAL.

A. ALLAN, Pres.

J. O. GRAVEL, Secy.-Treas.

F. SCHIOLES, M'g. Dir.

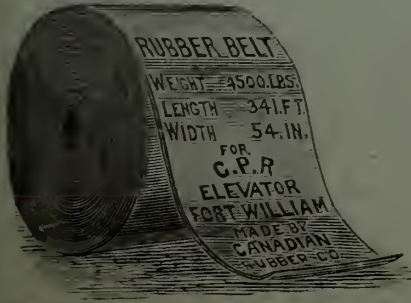
Manufacturers of

SUPERIOR QUALITY
RUBBER GOODS.

Our Rubber Belting is Un-
equalled in America.

Rubber Packings of all kinds.
Rubber Engine, Hydrant, Suction,
Steam, Brewers' and Fire Hose.
Moulded Goods of every description.

J. H. WALKER, Manager.



Western Branch cor. Front and Yonge Sts.,
TORONTO.

LIDGERWOOD MANUF'G CO.

96 LIBERTY ST, NEW YORK,

Largest Manufacturers in the United States of Hoisting Machinery of Every Description for Mines, Tunnel Work, Contractors, and General Hoisting Purposes.

IMPROVED HOISTING ENGINES

FOR MINING PURPOSES A SPECIALTY.

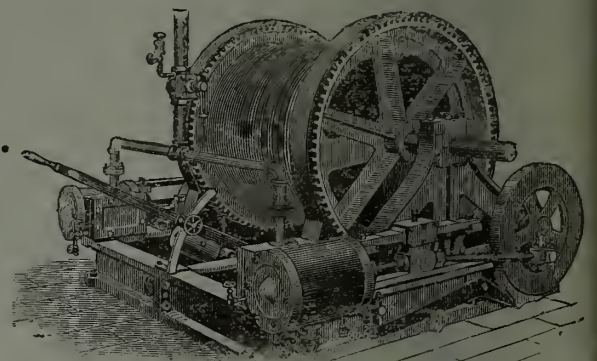
Over 5,000 Engines in Use!

300 Styles
and Sizes.

Send for
CATALOGUE.



FRICITION DRUM PORTABLE HOISTING ENGINE.



Double Cylinder Reversible Mine Engine.

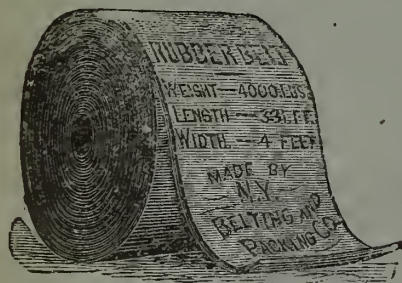
New York Belting & Packing Co.

15 PARK ROW, NEW YORK

JOHN H. CHEEVER, Treasurer.

J. D. CHEEVER, Dep'y Treasurer.

Oldest and largest Manufacturers in the United States of



RUBBER BELTING.

CIRCULAR WOVEN SEAMLESS, ANTI-SEPTIC RUBBER LINED

"CABLE" HOSE and TEST HOSE

For the use of Steam Engines, Force Pumps, Rolling Mills, Iron Works, Factories, etc. Woven in a superior manner to insure wear, compactness and durability.



"TEST HOSE."



Emery Vulcanite Wheel.

SOLID VULCANITE EMERY WHEELS

(Large Wheels made on iron centers)

Cuts Cooler and Freer than any other other wheel in the market.

W. D. ALLEN & CO.,
151 Lake St., Chicago.

H. D. EDWARDS & CO.,
Detroit.

European Branch: Pickhuben, 5, I'amlurg (Frühafengebeit), Germany.

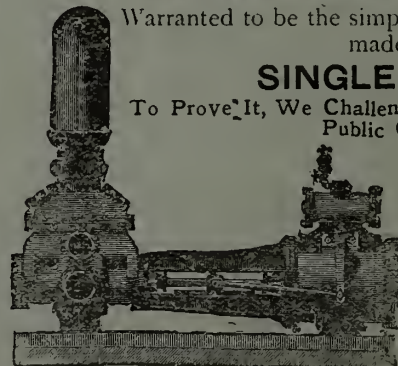
The M. T. DAVIDSON

IMPROVED MINING PUMP.

Warranted to be the simplest and most efficient Steam Pump made, whether it be

SINGLE OR DUPLEX.

To Prove It, We Challenge All Makers of Steam Pumps to a Public Competitive Test.



COMPOUND PUMPING ENGINES,

Obtaining a higher duty than any direct acting pump made.

MANUFACTURED BY THE

Davidson Steam Pump
COMPANY,

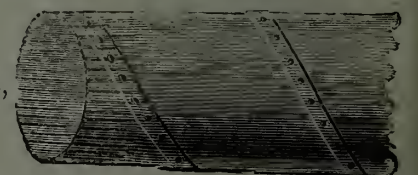
New York Office, - - - 77 Liberty Street.

ROOT'S

SPIRAL RIVETED PIPE

FOR

Hydraulic Mining,
Water Works,
Ranch and Railroad
Water Supplies.



From 2 to 24 inches in diameter and 1 to 25 in length. Manufactured with fittings to suit, capable of withstanding any desired pressure.

ABENDROTH & ROOT MFG. CO.

28 Cliff Street, New York.

Chicago Branch, - - SMITH & KNAPP, 312 Dearborn Street

Francis D. Taylor
MINING ENGINEER,
BROCKVILLE, - ONTARIO

SPECIALTY. — The Mining of Iron Ores, and the Manufacture of Iron and Steel.
Mr. T. has had for many years the management of large mining enterprises in England and the U. S. A.

CAMERON STEAM PUMP
SIMPLE, RELIABLE, COMPACT, DURABLE.
NO OUTSIDE VALVE GEAR.
THE A. S. CAMERON STEAM PUMP WORKS.
ADAPTED FOR ALL PURPOSES.
FOOT OF EAST 23^d STREET, NEW YORK.



VALUABLE PHOSPHATE LAND FOR SALE.

On Kingston and Pembroke Railway, and adjoining large producer. Also PYRITE IRON and other mines. Correspondence solicited.

WM. H. WYLIE, Carleton Place, Ont.

TAYLOR McVEITY, Barrister, Solicitor, &c.,

Supreme Court and Departmental Agent,
SCOTTISH ONTARIO CHAMBERS, OTTAWA.

WM. HAMILTON MERRITT, F.G.

Associate Royal School of Mines, &c.,
Mining Engineer and Metallurgist,
Will report on Mines and Mineral Properties.
ADDRESS:
15 TORONTO ST., TORONTO, ONT.

J. T. DONALD, M.A.,

Analytical Chemist and Assayer,
124 St. JAMES St. - MONTREAL.
Analyses and Assays of every description. Manufacturing processes practically tested. Laboratory instruction in Chemistry, Assaying and Mineralogy. Terms on application.

THE DOMINION Leather Board Co.

MONTREAL,

—MANUFACTURERS OF—

Leather Board & Stiffeners

ALSO OF

ASBESTOS MILL BOARD,

STEAM PACKING, and

FRICTION PULLEY BOARD.

Samples and prices furnished upon application.
Please mention this paper.



ONTARIO

Mining Regulations.

The following summary of the principal provisions of the General Mining Act of the Province of Ontario is published for the information of those interested in mining matters in the Algoma District, and that part of the Nipissing District north of the Mattawan River, Lake Nipissing and French River.

Any person or persons may explore for mines or minerals on any Crown Lands surveyed or unsurveyed, not marked or staked out or occupied.

The price of all lands sold as mining locations or as lots in surveyed townships is two dollars per acre cash, the pine timber being reserved to the Crown. Patentees or those claiming under them may cut and use such trees as may be necessary for building, fencing or fuel, or for any other purpose essential to the working of mines.

Mining locations in unsurveyed territory shall be rectangular in shape, and the bearings of the outlines thereof shall be due north and south, and due east and west astronomically, and such locations shall be one of the following dimensions, viz: eighty chains in length by forty chains in width, containing 320 acres, or forty chains square, containing 160 acres, or forty chains in length by twenty chains in width, containing 80 acres.

All such locations must be surveyed by a Provincial Land Surveyor, and be connected with some known point or boundary at the cost of the applicant, who must file with application surveyor's plan, field notes and description of location applied for.

In all patents for mining locations a reservation of five per cent. of the acreage is made for roads.

Lands patented under the Mining Act are free from all royalties or duties in respect to any ores or minerals thereon, and no reservation or exception of any mineral is made in the patents.

Lands situated south of the Mattawan River, Lake Nipissing and French River are sold under the Mining Act at one dollar per acre cash.

Affidavits showing no adverse occupation, improvement or claim should accompany applications to purchase.

A. S. HARDY,

Commissioner

Department of Crown Lands, Toronto.

The Canada Co.

Will issue Licences to Prospect or to work Minerals on any of their Mining Lands and Mineral Reservations,
Covering nearly a

Quarter of a Million Acres

In Eastern Ontario, and principally within the belts containing
Iron, Phosphate, Gold, Galena
Plumbago, Mica, Marbles,
Building Stone,
and other valuable Minerals.

For list of lands and terms apply to the Company's Mining Inspectors,

H. T. STRICKLAND,
Peterborough, Ont.,

For lands in the County of Hastings and westward, and to

ANDREW BELL, P.L.S.,
Almonte, Ont.,

For lands East of the County of Hastings.

SCIENTIFIC AMERICAN
ESTABLISHED 1845.

Is the oldest and most popular scientific and mechanical paper published and has the largest circulation of any paper of its class in the world. Fully illustrated. Best class of Wood Engravings. Published weekly. Send for specimen copy. Price \$3 a year. Four months' trial, \$1. MUNN & CO., PUBLISHERS, 351 Broadway, N.Y.

ARCHITECTS & BUILDERS
Edition of Scientific American.

A great success. Each issue contains colored lithographic plates of country and city residences or public buildings. Numerous engravings and full plans and specifications for the use of such as contemplate building. Price \$2.50 a year, 25 cts. a copy. MUNN & CO., PUBLISHERS.

PATENTS

may be secured by applying to MUNN & CO., who have had over 40 years' experience and have made over 100,000 applications for American and Foreign patents. Send for Handbook. Correspondence strictly confidential.

TRADE MARKS.

In case your mark is not registered in the Patent Office, apply to MUNN & CO., and procure immediate protection. Send for Handbook.

COPYRIGHTS for books, charts, maps, etc., quickly procured. Address

MUNN & CO., Patent Solicitors,
GENERAL OFFICE 351 BROADWAY, N. Y.

SPACE FOR SALE.

OPEN TO CONTRACT.

PORTABLE ENGINES AND SAW-MILLS

Of all capacities—from 3000 feet of lumber and up per day.

Saw-Mills.

Shingle-Mills.

Lath-Mills.

Chopping-Mills.

ENGINES

OF ALL SIZES.

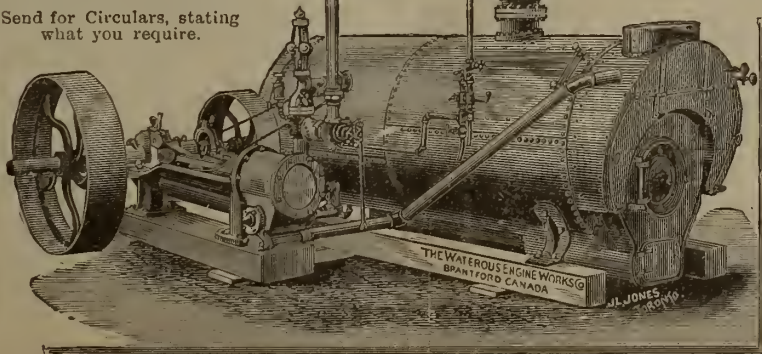
BOILERS

of all capacities,

IRON OR STEEL,

ALL STYLES.

Send for Circulars, stating what you require.



Waterous Engine Works Co. Brantford, Canada.
St. Paul, Minn., U.S.A.

TO MINERS AND OTHERS.

Bannerman & Powers,

VULCAN BOILER WORKS,

428 and 340 Wellington St., Ottawa.

MANUFACTURERS OF
IRON AND STEEL BOILERS

OF EVERY DESCRIPTION.

Tanks, Girders, Iron Roofing, Bank Vaults, Smoke Stacks

AND ALL KINDS OF

SHEET IRON WORK.

Repairs Neatly and Promptly Executed

ASBESTOS.

THEO. HAMEL,
44 Mountain Hill, Quebec,

SOLE ASBESTOS MANUFACTURER in CANADA

Write for prices and catalogue. Use Asbestos and save your money. Applied on boilers and Steam pipes it will prevent them from rusting and will economize 33% on fuel.

WILS N & GREEN,
Commission Merchants,
PHOSPHATE SHIPPERS.
AGENTS HIGH ROCK MINE.

17 St. Sacrament St., - - MONTREAL.

EDMUND SPARGO,
Consulting and Mining Engineer, 3 Cable Street,
Liverpool.

Owners of or Investors in Metalliferous Mines, Slate, Granite, and other Stone Quarries, Brick, Terra Cotta, Fire and other Clays and Mineral Estates in general, requiring reliable and sound advice either in the Purchase or Disposal thereof, should consult E.S., who has executed important professional Commissions in Germany, Austria, Hungary, France, Belgium, Spain, Portugal, Sweden, Norway, and in the various Mining Districts throughout Great Britain and Ireland. Telegraphic Address: "Spargo," Liverpool. Bankers, National Provincial Bank of England, Liverpool.

THOMAS HEYS,
Analytical and Consulting Chemist and Assayer.

References are kindly permitted by the following:
Messrs. Cooderham & Worts, Toronto, Limited; Messrs. P. R. Lamb & Co.; John Livingston, Esq., Dominion Bolt Co.
Assay and Analytical Laboratory
16 King St. West, opposite the Rossin House, } **TORONTO.**

A No. 1
Phosphate Property
ON RIDEAU LAKE

FOR SALE OR LEASE.
On favorable terms to party with not less than \$5,000 capital.
Highest grade mineral and inexhaustible quantity.
N. S. BENTLEY, 45 William St., New York.

W. Bredemeyer, Dr. Ph.
(LATE PARTNER OF JOHN McVICKER)
Mining Engineer, United States Surveyor and Assayer,
MASONIC TEMPLE BLOCK, VANCOUVER, B.C.

RELIABLE REPORTS, underground surveys and maps of mines executed at low rates. Assays made on all kinds of minerals, Gold and Silver Bars. Thirty years' experience in mining in Asia, Europe and United States of America. Speaks ten languages. Assays from a distance promptly attended to.
Address Vancouver, B.C.

Ottawa Boiler and Bridge Works

473-480-482 } OTTAWA { 476-478-480
Maria St. } Gloucester St.

W. J. CAMPBELL & CO
MANUFACTURERS OF
STEAM ENGINES, BOILERS,
TANKS, MINING PAILS,
DUMP-CARS
And every description of Wrought
Iron Work.

MINING WORK A SPECIALTY.

N.B.—Every Attention given to repairing by Experienced Workmen.

JAMES HOPE & CO..
BOOKSELLERS,
Stationers, Bookbinders and Printers,
OTTAWA.

SPEIGHT & VanNOSTRAND,

*Dominion and Provincial Land Surveyors,
Draughtsmen, Valuers, &c.*

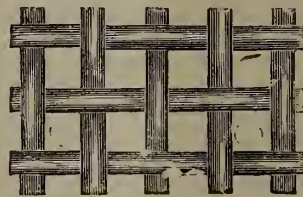
OFFICE: ROOM "J," FIRST FLOOR, TORONTO ARCADE,
YONGE ST., TORONTO.
Surveys, Plans, Descriptions of Properties, etc., promptly executed.
Timber Limits and Mining Claims Located.

MILLAR & CO.
General Merchants & Shipping Agents

ATLANTIC CHAMBERS,
209 COMMISSIONER ST., - MONTREAL
Cable address, "Hoyer, Montreal." P.O. Box 1095.
AGENT FOR The Canadian Phosphate Co., Ltd., of London, Eng.,
The Montreal Union Abattoir Co., of Montreal, Can.
English Correspondents Messrs. Couper, McCarnie & Co., London, England.
DEALERS IN Canada Phosphate, Ground Phosphate, Sulphate of Ammonia, Nitrate of Soda, Spent Bone Black, Hoofs and Horns, Fertilizers, Tankage, Dried Blood, Grease, Bones, Hair, etc., etc., etc.



For Mining Hoisting Derricks, etc.



Strong Wire Cloth and Screens

For Mining, etc., manufactured by

B. Greening & Co.
HAMILTON, ONT.

NATIONAL COLONIZATION
Lottery!

UNDER THE PATRONAGE OF
THE REV. FATHER LABELLE.
Established in 1884 under the Act of Quebec, 31 Vict.,
Chap. 38, for the benefit of the Diocesan Societies
of Colonization of the Province of Quebec.

CLASS D.
DRAWINGS ON THIRD WEDNESDAY IN EVERY
MONTH AT 2 P.M.

Prizes value \$50,000
Capital Prize: 1 Real Estate worth \$5,000.

LIST OF PRIZES.

1 Real Estate worth	\$5,000	\$5,000
1 Real Estate worth	2,000	2,000
1 Real Estate worth	1,000	1,000
4 Real Estates	50	2,000
10 Real Estates	30	3,000
30 Furniture Sets	200	6,000
60 Furniture Sets	100	6,000
200 Gold Watches	50	10,000
1000 Silver Watches	10	10,000
1000 Toilet Sets	5	5,000

2307 Prizes worth..... \$50,000
Tickets, \$1.00!

Offers are made to all winners to pay their prizes cash, less a commission of 10 p. c. Winners' names not published unless specially authorized.

S. E. LEFEBVRE, Secretary
Office: 19 St. James St., Montreal, Can.

W. Blakemore, F.G.S., M.E.,
Member of I. & S.I.

A. Montgomery Evans, M.E.,
of Canada & U.S.

BLAKEMORE & EVANS,
MINING & CIVIL ENGINEERS
Exchange Buildings, Cardiff, S.W.

LONDON OFFICE:
Robert H. Jones, 82 Queen St., Cheapside, London, E.C.

Reports, Estimates, and Valuations made on Iron and Steel Works,
Blast Furnaces, and all classes of Mining Properties.

CANADIAN BUSINESS PROMPTLY ATTENDED TO.

To Prevent Boiler Explosions

And other accidents to steam boilers, and to secure
economy in working, insure with

**THE BOILER INSPECTION
AND INSURANCE COMPANY OF CANADA.**

Sir Alex. Campbell, K.C.M.G., | John L. Blaikie, Esq.
President. Vice-Pres.

HEAD OFFICE: - - - - - TORONTO
G. C. ROBB, Chief Engineer.

A. FRASER, Sec'y-Treas.

ORFORD COPPER CO.,
COPPER SMELTERS.

Works at Constable's Hook, N.J., opposite new Brighton,
Staten Island. Copper Ore, Mattes, or Bullion
purchased. Advances made on consignments for refining and sale. Specialty made of Silver-Bearing
Ores and Mattes.

SELL

INGOT AND CAKE COPPER.
President, **ROBERT M. THOMPSON.**
Treasurer, **G. A. LAND.**
Office, 37 to 39 Wall Street, New York.

Robin & Sadler,
MANUFACTURERS OF
LEATHER BELTING

TRY OUR

Waterproof Belting,
Just the thing for Mining Machinery.

MONTREAL, TORONTO,
2518, 2520, 2522 Notre Dame St. 129 Bay Street.

STEEL IN STORE
"JESSOP'S"

Standard Durable Cast Steel. Best value for consumers.
Also Machinery Steel.

A. C. LESLIE & CO.,
Montreal and Toronto.

T. D. LEDYARD,
DEALER IN MINERAL LANDS
4 ONTARIO CHAMBERS, TORONTO.

Will buy undeveloped iron ore and other mineral properties.
WANTED. — Deposits of Magnetic Iron Ore, Red Hematite,
Brown Hematite, Galena, Iron and Copper Pyrites, Mica, Soapstone, Marble, Gypsum, Baryta. Samples can be sent by Sample Post for 1 cent for 4 oz. or up to 24 oz. in weight.
Information regarding mines cheerfully given. Correspondence solicited. Crown Land Business attended to.

CHEMICAL APPARATUS! OF EVERY DESCRIPTION.



Glass, Porcelain, Stoneware, Platinum Crucibles of every sort, Analytical Scales and Weights, Fine Chemicals and Reagents, including Volumetric Solutions. Every requisite for Analysis or Experiment. For Sale by

LYMAN, SONS & CO.,
334 St. Paul St., Montreal.

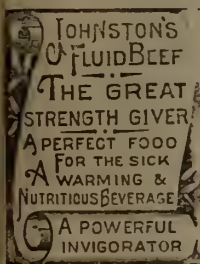
Illustrated Catalogue mailed on receipt of 10c. or Business Card.

Boiler For Sale.

N EIGHTY H.P. TUBULAR STEEL BOILER made by W. C. White, Montreal, 15 ft. x 5 ft. 4 in. eighty 3 1/2 in. tubes; smoke stack 45 ft. long; guylards and guys. Very little used. Equal to new. Price on cars, \$600. Address

P. O. Box 6,
MONTREAL.

Johnston's Fluid Beef



CONTAINS
ALL THE ELEMENTS,

Without a single exception,

For the formation of Flesh,
Muscle and Bone.

IT IS INDISPENSABLE TO
THE INVALID

seeking health; TO THE ATHLETE seeking to develop strength of muscle; FOR CHILDREN to lay the foundation of strong bodies; to the HOUSE-WIFE to make rich gravy and strong soup.

Victor Electric Fuses.

Superior to all others for Exploding any make of Dynamite, High Explosives, or Gelatine Powder. Each Fuse is tested and warranted extra strong and waterproof. Low grades of Dynamite Powder will do ten per cent. more execution if detonated with Victor Electric Fuses.

VICTOR BLASTING MACHINES.

Latest improvements, made in three sizes, easy to operate, strong and durable. No expensive repairs, low in price, will fire any make of Electric Fuses.

MANUFACTURED ONLY BY

JAMES MACBETH & CO.,

128 Maiden Lane, N.Y., U.S.A.

Send for Catalogue.

FOR SALE.

A COAL MINE IN CAPE BRETON,

Area, 970 acres, underlaid by 6 or 7 beds of the best Coal in Nova Scotia. The property is estimated to contain from 50 to 60 million tons of Coal. No Coal Mine can be more easily or cheaply operated. The angle of dip is 6 degrees, and the rock stratification is remarkably even and without fault or break.

Apply to

ALEXANDER CAMPBELL,
Annapolis Royal, N.S.

Electric Pumping in Collieries.—The application of electricity to underground pumping has enabled Mr. F. Brain to give particulars which prove that this is a method of transmitting energy capable of wide and economical application. The electric pumping plant, which the author describes, has been put in to deal with the main feeder of water in the deep working of the Trafalgar colliery, Forest of Dean. The pump and motor are placed at a distance of 1650 yards from the bottom of the shafts and water has to be forced by this pump to a vertical height of 300 feet to the pit bottom. The pump, a double 9 inch plunger with 10-inch stroke, is driven by the motor running at 650 revolutions per minute to 25 revolutions of the pump. Trials gave for the engine 29.49 indicated horse power to 10.36 actual horse-power of water lifted. The actual proportion of power given off by the steam engine used to lift water is therefore 35 per cent. The first cost of the plant was £644, the pump (£130) and pipes not being included. The cost of pumping 114 gallons per minute with this machinery, through 1300 yards of 7-inch pipes rising 300 feet vertically, is £7 17s. for one week's pumping, twenty-two hours per day, or in other words 0.02d. per horse-power, or 1.8d. per 1,000 gallons of water raised. When not required for pumping, the power available is used to drive a small fan underground.

Premature Explosions of Gunpowder.

—W. H. Williams, writing to the London *Miner's Journal* says: "I have had a very extended experience with blasting by gunpowder in mines, and from careful daily observation I found that one cause of premature explosion resulted from charging the bore hole with naked powder, loose grains of the powder rest on their way down on the projecting and irregular sides of the bore, and when the stemming was done a bit of grit in the tamping, striking, or giving off a spark would convey fire to the powder charge by these loose grains of powder, and a premature explosion would be brought about. The other cause was that the naked powder filled up a greater part of the bore hole when first run in than it would occupy when stemmed, consequently the metal stemming bar, being of small diameter than the bore hole it went down in the powder charge, leaving a lining of the explosive some distance up its sides, forming really a hole lined with powder. Stemming then goes on, and a bit of grit or other exciting cause producing a spark, the powder charge is exploded prematurely. I have known charges of powder go down 3 and even 5 inches when rammed or stemmed below the point they stood at when loosely run into the bore hole. To remedy these very dangerous and sometimes fatal occurrences I first had every powder charge placed in a good case (cartridge) and gently but firmly pressed to the bottom of the bore hole. placing on top of these a small woollen wad about three inches long made of pump ring lagging (called engine shaggy). This wadding was a strip about 4 inches long and 3 inches wide tied tightly in the middle and allowing both ends to spread out something like a figure 8 flattened top and bottom. This went down on the cartridge and not only would it brush down all loose grit but spread out all over the unequal sides of the bore hole and set up a perfect non-conducting separation between the material used for stemming or ramming, and the powder in the bottom of the bore hole.

ALEX. RANKIN,

20 Toronto Street, Toronto Ont.

Agent for sale of Mines and Mineral Lands.

CORRESPONDENCE SOLICITED.

Agents in England and New York.

E. H. SARGENT & CO.,

IMPORTERS AND DEALERS IN

ASSAYER'S MATERIALS,

Chemicals and Laboratory Supplies.

125 State Street,

CHICAGO.

HARRIS & CAMPBELL

Latest Designs in Drawingroom, Diningroom and Bedroom

FURNITURE

With improved Steam Machinery our facilities for manufacturing Cabinet Goods are complete. Our upholstery Department is well stocked with latest imported patterns.

Corner **QUEEN & O'CONNOR Sts.**
OTTAWA.

THIS YEAR'S

MYRTLE

CUT AND PLUG

Smoking Tobacco

FINER THAN EVER.

SEE

T & B

In Bronze on Each Plug and Package.

THE DOMINION

SAFETY BOILER CO.

MANUFACTURERS OF

The "Field-Stirling" Patent High Pressure Boiler,

The Safest and Cheapest Steam-Generator now in Use.

This Boiler is unusually durable, being made of the best steel and wrought iron exclusively. No cast-iron is employed. It is simple in construction, has a rapid, well-defined circulation, and a large cool mud-drum, where all impurities are collected to be blown off. All parts of the Boiler are readily accessible for the closest inspection. It has great excess of strength and is not liable to be strained by unequal expansion. The water space is divided into sections so arranged that NO EXPLOSION IS POSSIBLE.

Some of Our Leading Customers:

The J. A. Converse Mfg. Co. (A. W. Morris & Bro.), Montreal; The Canada Sugar Refining Co., Montreal; The Pillow and Hersey Mfg., Montreal; The Berthier Beet Root Sugar Co., Berthier, Que.; The Imperial Insurance Co., Montreal; The Massey Manufacturing Co., Toronto; The Acadia Coal Co. (Ltd.), Stellarton, N.S.; Canada Paper Co., Windsor Mills, Que.; Royal Electric Co. (Central Station), Montreal; Dodge Wood Split Pulley Co., Toronto, and a repeat order from A. W. Morris & Bro., after five months' experience; Ingersoll Rock Drill Co. of Canada.

We guarantee Dry Steam and Great Economy of Fuel. Correspondence Solicited.

J. FRASER TORRANCE, M.E.

P.O. Box 1707, Montreal.

Manager.

If you want

BAGS

FOR PACKING

ASBESTOS, PHOSPHATES, ORES, &c.,

Send to us for Samples and Prices.

Every quality and size in stock.

Specially strong sewing for heavy materials.

Lowest prices compatible with good work.

We now supply most of the Mining Companies, and those who have not bought from us would find it to their advantage to do so.

THE CANADA JUTE COMPANY (LTD.)

17, 19 & 21 ST. MARTIN STREET,

Established 1882.

MONTREAL.

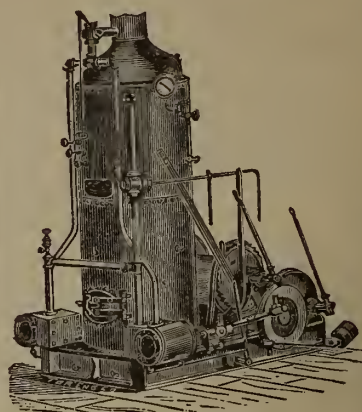
M. BEATTY & SONS,

WELLAND, ONT.

HOISTING
ENGINES

ENGINES

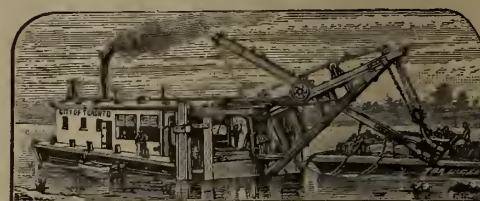
FOR
Mines
AND
Inclines



Horse-Power Hoisters,

Stone Derrick Irons,

Centrifugal Pumps.



DREDGES,

DERRICKS,

STEAM SHOVELS,

And other Contractors' Plant.

AMALGAMATING MACHINERY.

Stamp Mills for Wet or Dry Crushing. Huntington Centrifugal Quartz Mill. Drying Cylinders. Amalgamating Pans. Settlers, Agitators and Concentrators. Retorts, Bullion and Ingot Moulds, Conveyors, Elevators, Bruckners and Howell's Improved White's Roasting Furnaces, Etc.

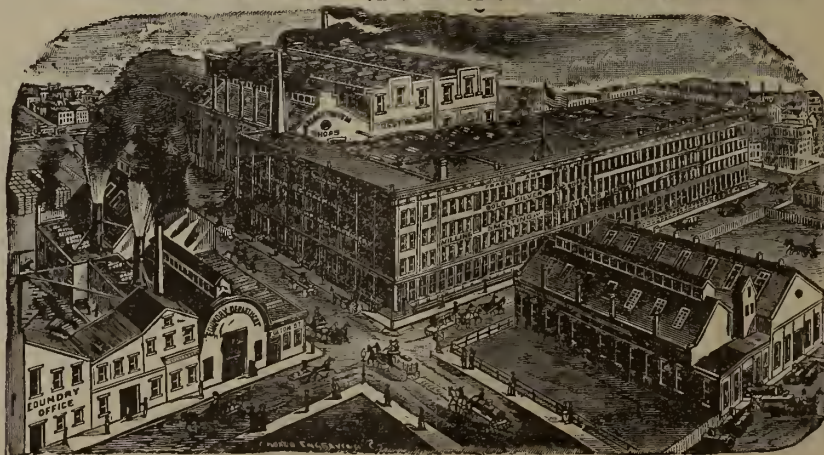
CONCENTRATING MACHINERY.

Blake, Dodge and Comet Crushers, Cornish Crushing and Finishing Rolls, Hartz Plunger and Collom Jigs. Frue Vanner & Embrey Concentrators, Evans', Calumet, Collom's and Rittenger's Slime Tables. Trommels, Wire Cloth and Punched Plates. Ore Sample Grinders and Heberle Mills.

FRASER & CHALMERS, MINING * MACHINERY.

Improved Corliss and Slide-Valve Steam Engines,
Boilers--Horizontal, Vertical and Sectional,
IMPROVED STEAM STAMPS.

Hoisting Engines, Safety Cages,
Safety Hooks,
Ore Cars, Water and Ore Buckets,
Air Compressors, Rock Drills, Etc.
General Mill and Mining
Supplies, Etc.



Pumping Engines and Cornish
Pumping Machinery,
Improved Water Jacket
Blast Furnaces for Calena and
Copper Ores.
Slag Cars and Pots,
Roots & Baker Pressure Blowers,
Suspended Tramways.

Sectional Machinery for Mule-Back Transportation.

General Offices and Works: FULTON & UNION STS., CHICAGO, ILL.

BRANCH OFFICES: NEW YORK, Room 43, No. 2 Wall St. DENVER, COLO., 1316 Eighteenth St. SALT LAKE CITY, UTAH, 7 West Second South St. LONDON ENGLAND, 23 Bucklersbury, E. C. CHIHUAHUA CITY, MEXICO, No. 11 Calle de Juarez. LIMA, PERU, South America. JOHANNESBURG, TRANSVAAL, South Africa.

The Canadian Mining Review

CONDUCTED BY . . . B. T. A. BELL

OFFICES:

UNION CHAMBERS, 14 Metcalfe St.
OTTAWA.

Vol. VIII. MARCH, 1889. No. 3.

Obituary.

Sir John Morris, Kt., J. P., Chairman of the Anglo-Canadian Phosphate Co., Ltd., died Feby. 27th, at his residence, Enfield, London, from inflammation of the brain. He was for many years head of the firm of Morris & Griffin, fertilizer manufacturers, Wolverhampton, and was one of the earliest English investors in Canadian phosphate lands. He was formerly Mayor of Wolverhampton, and was for ten years Chairman of the Chemical Manure Manufacturers' Association. The deceased gentleman was greatly beloved for his many amiable traits and was highly esteemed for his business integrity.

The Geological Survey. Its Staff and its Director.

As a country expands and progresses it is only natural that its public institutions should correspondingly keep pace with its growth, and when these are kept up by money voted by parliament, it is to be expected that their management should be watched by the people, and their action commented upon. A wise government, to foster the industries of its country keeps up establishments intended to aid these industries by their investigations, experiments, and researches, and by announcing results so afford their experience to all interested. The experimental farms will be of untold value to the agriculturist and the intending settler in a country new to him; and in like manner the Geological Survey is of the utmost value to the miner, the prospector, the capitalist and intending investor in mineral lands. In the earlier days of Canada when Sir William Logan almost single-handed undertook the work of a Geological Survey, a comparatively small area of that which now forms the Dominion, was invested with any particular degree of interest, and his labours met all the requirements of his day. Now with the unbroken sweep of country from ocean to ocean and territory extending to within the Arctic circle giving evidence of mineral wealth, some idea may be formed of the increase of work the Geological Survey Director has to control, and the wonder is how with the comparatively limited staff and means at his disposal, so much work has already been achieved, as the annual reports of the Survey show Dr. Selwyn to have accomplished and to be still carrying on. It is not our province to flatter or adulate an official for doing his duty; that, the country expects of him; but we do feel that it is not out of place

in a publication like the CANADIAN MINING REVIEW to defend an official when unjustly attacked. These remarks are drawn forth from a telegram which appeared in the *St. John Globe* of the 17th February last, belittling Dr. Selwyn, and charging him with favouritism and partiality in selecting localities for survey. It is not the object of the institution he controls to advertise mining properties in any one locality by giving them a preferential report, but it is its object to follow up any new discoveries made by individuals and to publish the results of its labours in such districts for public use. Such a course may have led jealous persons to assert some particular survey as savouring of partiality, but it is only ignorant or disappointed parties whose minds could conceive such narrow views of Dr. Selwyn, whose career of scientific investigation can be pointed to as evidence of his whole course of impartial action through life. As an evidence of the esteem in which his work is held abroad, the comments of men of standing in the United States and elsewhere give no uncertain sound. Mr. E. E. Thompson of New York, says of the maps published by the Director that they are "truly magnificent; my highest expectations are more than realized in them; they are indeed models of method and precision, and the most noble monuments to their originator." Another gentleman of very high standing in the Lower Provinces speaking of Dr. Selwyn's maps says: 'It is my unbounded appreciation of what has hitherto been done by the corps of the Geological Survey under the Directorship of an able and eminent chief of whom Canada may well be proud, that prompts me to suggest and impels me to advocate the expenditure of a few tenths of a cent more apiece, to enable the Survey to continue recording and establishing in the most satisfactory manner work that *is being well done*, and which ensures to the industrial development of the country while it will be at the same time a source of honest national pride *when we compare our record with that of other countries*.' Surely such comments as these speak volumes for Dr. Selwyn's ability and work, and the comments of the *St. John Globe* depreciating these labours would not be worthy of notice, were it not that if allowed to stand unnoticed, the idea might gain ground that there was some cause for them. Any visitor to the Geological Museum must at once be struck with the order and arrangement existing in the display of its specimens, and when the small vote at the disposal of the Director is taken into account, the only wonder is how so much can be made out of so little at his disposal. The vast extent of territory represented by specimens testify to the field work done, and the annual reports are an index of the care bestowed on the outdoor labours of the staff. Dr. Selwyn can afford to stand all attacks without harm being done, but at the same time narrow minded and ill-natured thrusts which irritate like a thorn in the flesh, require like the latter a magnifying glass to show their insignificance, and when disposed

of share the fate of the thorn, in being cast aside as worthless matter. While upon this subject we would again remind the Federal Government that the accommodation provided for this important branch of the public service is utterly inadequate to its wants and uses. The present building, besides being too small, may be destroyed by fire at any time. Just now it contains probably the most precious collection of minerals, fossils, and botanical specimens contained in any one building on the North American continent. The loss of such would be irreparable. We trust that in order to do justice to this valuable collection, the day is not far distant when the Geological Survey and Natural History museum will be provided with a much more commodious building than that which it now occupies, and that the present able director may be spared in health and strength to assist for many years to come in its management and supervision.

The American Institute of Mining Engineers to Meet in Ottawa.

Our readers will be gratified to learn that arrangements have been made for holding the fall meeting of the above Institute in Ottawa early next October. The suggestion was made by Dr. Bell of the Geological Survey, Mr. R. G. Leckie and Major Markham, Canadian members, who attended the late New York meeting, and was very warmly received. A meeting was held in the office of the CANADIAN MINING REVIEW on 5th inst., when it was decided to call a larger one. This resulted in a very influential gathering in the City Hall on the 8th inst., at which it was resolved to invite the Institute to Ottawa and to take steps to raise money for their proper reception. A deputation consisting of upwards of twenty leading citizens and members of parliament for Ottawa and the surrounding counties waited upon Sir John Macdonald and requested aid for this purpose. In response the Government has agreed to grant \$1,000. This, it is confidently expected, will be largely increased by the governments of Ontario and Quebec. The consent of the Council of the Institute was required in order to appoint Ottawa as the place of meeting. This has been obtained, and the secretary, Dr. Raymond, has written that the way is now clear for us to have the autumn meeting. This will be a great boon. The Institute numbers over 2,000 members, and embraces wealthy mine owners and distinguished practical scientists. Their coming to the Capital of the Dominion will increase the importance of Canada and Ottawa, not only to our neighbours, but to the world generally. Excursions will be organized to our mining districts in all directions. These will have the effect of bringing our phosphate, mica, iron, copper, gold, silver and other mines under the direct personal notice of the men most likely to invest or to influence the investment of money in them, and will be certain to lead to sales of

both developed and undeveloped properties. Other interests will also be sure to benefit, as the average American is always open for any opportunity for the profitable investment of money.

The interest which capitalists may take in our mining districts will necessarily be heightened after personal investigation. Even those who may not invest, if they are afforded a pleasant visit will come again. One good feature of these meetings of the Institute is that the members always bring their ladies with them, and friendships formed at agreeable meetings often last for life. By making the acquaintance of our own scientists they may draw from them some of their hidden knowledge, and the meeting may thus be advantageous. The reading and discussion of papers on subjects of practical importance will be a treat to our citizens and mining men; and the speciallists in different departments may give valuable hints or advice on the ground during their visits to the various mining districts. The publication of the volume of Transactions referring to the "Ottawa Meeting" will tend to bring this region into prominence in mining circles throughout the world.

We have so far said nothing of the direct and immediate advantage which our city and the country generally will derive from the visit of such a large number of strangers with money to spend. Our railways, steamboats, hotels, shops, cabmen, etc., will profit to a very considerable amount in the aggregate, although this will be insignificant in comparison with the larger advantages which will be sure to follow.

Since this was written, the Provincial Government of Ontario, with a foresight that does it credit, has made a grant of one thousand dollars to the fund. We now look to the Province of Quebec for a similar contribution.

Phosphate Quality.

Much perplexity has been occasioned in the minds of Canadian phosphate producers and dealers by the variation in the demand for quality on the part of English buyers of phosphate. When the trade began, some 12 years ago, no guarantee over 70 per cent. was ever asked for. In a few years 75 per cent. guarantees were required, and then 80 per cent. was strenuously demanded, and for the past three or four years anything under that standard was very difficult of sale, or had to be disposed of at much lower relative prices. The reason generally adopted by Canadians as an explanation of this demand for high guarantees was that owing to the great uncertainty of the results of sampling and analysis the buyer often had a chance to buy in at a low price a good lot of phosphate which had chanced to be rated below the guarantee standard and was therefore rejected. However this may be, there has been a sudden reaction since last summer from this practice and up to the present not a ton of 80 per cent. phosphate has been sold for next season's delivery to England, while there has

been a lively demand for grades below 75 per cent., and lower qualities have been sold than ever before, in fact phosphate that has heretofore been thrown upon the dump as worthless is now found to be marketable. An explanation has just been received from an English correspondent that throws new light upon the subject. It is well known that our phosphate, after being finely ground, is mixed with about an equal weight of sulphuric acid in order to render it soluble in water. In this state it is known as superphosphate. It is found that, although at first nearly the whole quantity of phosphate may be rendered soluble by the acid, after a while a portion "reverts" or becomes insoluble again, and as it is usual to sell superphosphate upon the basis of the "available," or soluble, phosphate that it contains so that what has reverted becomes a loss to the manufacturer, or if sold on the full analysis the farmer may think he has sustained a loss. Canadian phosphate is higher in quality than almost all others, but is said to revert more than do some of the lower grades. These remarks will explain the words of our correspondent, who says, "It must be remembered that not only are manufacturers wishful to get a price for the phosphates that revert, but farmers are beginning to see that it is better to buy at a low price supers of say 26 per cent. phosphoric acid (equal to about 57 per cent. of phosphate of lime) than to give a relatively very much higher price for a higher percentage superphosphate, and the bulk of the trade is now in supers of about 26 per cent. phosphoric acid, which can readily be made from the low class easily worked phosphates, and this is, of course, against high grade Canadian."

Very likely reasons may be found to change back again to the use of higher grades, but even if it is not so there is enough low grade phosphate in all Canadian mines, heretofore discarded, which, if judiciously mixed with the high grade and the expense of cobbing dispensed with, will render the returns of this industry more profitable than ever.

The Canadian Asbestos and Antimony Company, (Limited.)

This Company has been formed in London to purchase and develop certain mineral properties owned by Dr. James Reed in the eastern townships, comprising 16½ square miles, with mining rights over 9,500 acres in addition. The capital is fixed at £160,000, in £5 shares, of which 22,000 are now offered for subscription at par. The purchase price is £130,000, payable £30,000 in cash, and the balance in shares, leaving £30,000 for working capital. The Directors of the new concern are: Sir Henry A. Isaacs, St. George's House, Eastcheap, London, Chairman; The Right Hon. Lord Gifford, V. C., Reigate, Surrey, Vice Chairman; David J. Carmichael (late senior member of Council, Madras), 21 Sussex Gardens,

London, Lieut.-Col. H. C. Gleadow, 5 Cornwall Gardens, London, W. A. Vanderbyl 3 Great Winchester Street, London, and R. H. Jones, 82 Queen street, Cheapside London. The local board in Canada includes Hon. Francis Laugelier, M.P., and Mayor of Quebec; Frank Ross, Director of the Quebec Bank, Quebec; and Dr. James Reed, Reedsdale. The properties to be acquired are: (1.) The Nicolet freehold estate, containing 2,267 acres, seven miles from Garthby station on Quebec Central Railway; (2.) a freehold estate at Thetford, comprising 7,776 acres, with mining rights over 9,500 acres; (3.) the Coleraine freehold estate, lots 27, 28 and 29, containing 450 acres. The *Financial News* and *Financial Times* speak very favourably of the scheme and its promoters; but the *Stock Exchange Times* describes the project as "another attempt to draw funds from easy going people who have more money than wits." This paper concludes its criticism thus: "The vendors will take £80,000 out of it, and they will considerably leave £30,000 for working capital. Kind folks! What care they if the estates remain undeveloped and unprofitable for lack of adequate capital to work the deposits of asbestos and the 'seams of antimony?' Their exploitation is in the inexhaustible field of credulity which distinguishes the British investors. Let that much-abused class for once abandon its idiocy and be wise. The end of investment is profit—this is an excellent rule; the end of this scheme is the sole profit of the vendors and promoters, *et hoc genus omne*." No authentic information bearing upon the extent and richness of the mineral deposits said to be found upon the two first mentioned properties is to be had, and we are therefore not in a position to speak of their value. The Coleraine property, on the other hand, has been partially opened up, and Dr. R. W. Ellis, in his recent report to the Geological Survey, speaks very favorably of it as a probable asbestos producing property. We understand that in consequence of these disparaging remarks Lord Gifford has requested the Geological Survey to furnish him with full information, and with this object in view it is not unlikely that a special examination of the property will be made.

Largest Producing Gas Well of New York—According to Mr. C. A. Ashburner, the greatest amount of gas ever discharged per diem from any well in the State of New York was from the McMullen and Hallock well, commonly known as the "Mullen Snorter." This well is situated in Olean township, Cattaraugus county. Gas was struck on May 30, 1877, at a depth of 1,180 feet, in a sand bed 25 feet in thickness. The Bradford oil and gas sand proper was struck at a depth of 1,230 feet. From careful measurements on June 1, 1877, the author determined the discharge of gas to be at the rate of 24,480,000 cubic feet per day of 24 hours. With the gas there was discharged about a barrel of oil per day. The discharge of gas continuously decreased until 1882, since which date the well has produced two to three barrels of oil per day, with a comparatively small amount of gas.

The Vancouver Coal Mining and Land Company.

An extraordinary general meeting of the above company was held at the London offices on Tuesday, 5th ulto. Mr. Galsworthy presided, and the proceedings only lasted a few minutes. There were very few shareholders present.

It was stated that the meeting was called as the directors had found it necessary to formulate a scheme for the reconstruction of the company on more convenient lines. The following is the scheme as set forth in a circular sent round to the shareholders: "A new company will be formed to be called the New Vancouver Coal Mining and Land Company (Limited), with enlarged powers and appropriate regulations. The discount shares, other than few which by estoppel have been confirmed, will be specially acquired by the new company in the terms of an agreement already entered into with them, by virtue of which the holders of each discount share will be entitled to 10 1/2 fully paid shares in the new company; the assets and liabilities of the existing company will be made over to and undertaken by such new company; the members of the existing company will receive 10 1/2 shares in the new company for each 10% share fully paid in the present company, and 10% shares with 18s. per share credited as paid up thereon, for each 10% share with 9% paid up thereon in the present company; and the existing company will, in due course, be dissolved." The principal objects claimed to be attained by this reconstruction are: (1) To overcome the difficulty created by the recent decision of the Court of Appeal in *re Almada and Tinto Company*, where it was held that the issue of shares at a discount was *ultra vires*, and to place the holders of such shares in this company in the position which all parties intended that they should stand; (2) to remove the existing difficulties in the way of a declaration of dividend, and (3) to remove any doubt that may exist as to the company's power to sell its entire undertaking to Messrs. Rosenfeld or otherwise.

The chairman moved the following resolutions, which were duly seconded and carried:

"That it is desirable to reconstruct the company, and to transfer the undertaking thereof to the New Vancouver Coal Mining and Land Company (Limited), and with that view thereto the company be wound up voluntarily, and that Mr Joseph Ramsden should be and is hereby appointed liquidator for the purpose of such winding up."

"That the draft agreement submitted to this meeting, and expressed to be made between this company and its liquidator of the one part, and the New Vancouver Coal Mining and Land Company (Limited) of the other part, be and the same is hereby approved, and that the said liquidator be and he is hereby authorized, pursuant to section 161 of the Companies Act, 1862, to enter into an agreement with such new company, in the terms of the said draft, and to carry the same into effect with such, if any, modifications as he may deem expedient."

These resolutions were carried unanimously.

The chairman explained that a call of 20s. per share had been made on the 9% shares; also that a bonus of 20s. per share had been declared on all the shares of the company, both payable 30th April next. This was done to equalize the shares, which would place them on a much better footing than they had been in the past. The reports from the mines were satisfactory, the output for the month of January being 29,000 tons. There was little doubt

Mr. Rosenfeld would purchase the undertaking from the company, and then the shareholders would get about 12% per share instead of about 7% per share if their shares were sold at present. There was no other business.

Silver Wolverine (Limited).

The shareholders of the above company held their first ordinary general meeting on Tuesday, 5th ulto, at the offices, 115 Cannon Street, London.

Major General W. O. Swanston presided. The directors, he said, had nothing to tell the shareholders. There was no report to make and no accounts to present, and at present no dividend for them. He did not know that he had anything to do, except, perhaps, to introduce the directors to the shareholders. Upon the table was some of the stuff that had come out of their property. He might inform the meeting that work had been commenced. They had erected several buildings for the workmen and stables for the horses, and had actually commenced to dig. The last telegram they received from their engineer was dated February 1, and was as follows:—"Wolverine looking well. Sinking by contract in good milling ore." Before that they received a report from another engineer, to whom they wrote on the subject, asking him for information as to the cost, and he concluded his report thus:—"I would say that the Wolverine vein is similar in character to all the best mines in the section, and as far as can be seen you have good reason to expect the Wolverine will develop into as good a property as the Beaver and the Badger." So far as they had gone their condition and prospects looked hopeful.

Mr. Pearson: I should like to ask one or two questions. First, whether it is correct that the directors proceeded to allotment before half the number of shares reserved for the public were subscribed for—that, is, before 10,000 out of the 20,000 shares were subscribed for? Also whether out of that less than 10,000 shares 5,000 were not subscribed for by one man alone? I should further like to know whether, after allotment, the directors sent out to Canada a person to ascertain whether the capital which had been subscribed was sufficient to start with, and, if so, why that information was not obtained previous to allotment?

Major J. A. Winter (director): The amount allotted really is 9,695 shares, and that comes to the same number of pounds, and here is the estimate for the works, which amounts to about 4,700%. That ought to satisfy you, considering we are told that before working a year we shall be paying a dividend.

Mr. Pearson: My next question is as to whether the directors after allotment did not find it necessary to send someone out to Canada to ascertain the amount of money which would be necessary to work the mine, and, if so, why that information was not obtained previous to allotment? (Hear, hear.) My reason for asking that is because I understood when I subscribed for my shares directors who had put their names at the back of the prospectus were fully acquainted with all the information which it was necessary to obtain for the development of the mine. But if it was found necessary after allotment to send out someone, then I suppose the directors did not understand the amount of money that would be necessary.

The Chairman: The first estimate that we had before we took any steps was that it would be about 4,000% for the working of the first year.

To satisfy ourselves that that was right we sent out to an independent engineer for his estimate. His estimate arrived after we had made some of the allotments, and that estimate coincided almost exactly with the one sent before as to amount, except that he included machinery, boats, horses, and waggon, which we had to purchase. These are all the things that we had to purchase the first year, and we shall not have to do so the second year. The whole of that makes a little over 4,000%, and we have 10,000% to work with; and if we make anything at all, we shall make it before we spend 10,000%.

In reply to the question it was stated that working had commenced in the mine.

At the conclusion of the ordinary an extraordinary meeting was held to consider the following resolutions:—"That the following Articles be added to the Articles of Association of the company—Share warrants to bearer: (133) The directors, with respect to any fully paid-up shares, or with respect to stock may, if they think fit, issue share warrants, stating that the bearer is entitled to the shares or stock therein specified, and may provide, by coupons or otherwise for the payment of future dividends on the shares or stock included in such warrants. (134) The directors may determine, and from time to time vary, the conditions upon which share warrants shall be issued, and in particular upon which a new share warrant or coupon will be issued in the place of one worn-out, defaced, lost or destroyed; upon which the bearer of a share warrant shall be entitled to attend and vote at general meetings, and upon which a share warrant may be surrendered, and the name of the holder entered in the register in respect of the shares or stock therein specified. Subject to such conditions and to these presents, the bearer of a share warrant shall be a member to the full extent. The holder of a share warrant shall be subject to the conditions for the time being in force, whether made before or after the issue of such warrant."

The company's solicitor (Mr. Philips) explained that the resolution was proposed in order to give the directors power to issue share warrants, so as to enable the shares to be dealt with. The directors thought it possible that there might be some dealings in the Paris market in the company's shares, and therefore they proposed to take power to issue the share warrants. They had not yet actually decided whether they would issue them. The resolution must be passed by three-fourths of the meeting present.

After some discussion, Major Winter said it was not compulsory for any shareholder to have dealings as suggested. It might strengthen the company, and could not do any harm. Supposing a shareholder went to the Paris market and made a market for his shares, others would be inclined to do the same thing. There would be little expense to the company beyond the printing and registering at Somerset House. The only other expense would be to the individual.

The resolution was carried unanimously.

PHOSPHATE.

WANTED—Large and Small PHOSPHATE PROPERTIES (developed preferred). Address, with full particulars,

J. C. RITCHIE,

Room 31 No. 34 New St.,

NEW YORK CITY.

The Asbestos Industry, 1888.

Dr R. W. Ellis.*

The asbestos industry of Thetford and Coleraine continues to rapidly increase in importance. The formation of the new Bell Company of London during the past season, by which detached areas have been brought under one management, and the wonderful advance in the stock, has incited fresh explorations, and several new openings have been started. Prospecting has been active during the past season, not only in Thetford and Coleraine but in the great serpentine area of Wolfestown, and good indications of asbestos have been found at several new points. But the largest quantity and the best quality of fibre continues to be derived from the Thetford mines, though the very bad season of 1888 has reduced the output very seriously. The asbestos at these mines differs very materially from the greater part of that obtained at other points, both in Broughton on the one hand and in Coleraine on the other. That from Coleraine and Wolfe is to a certain extent affected by a harshness and stiffness which pertains to a very considerable portion of the output, rendering the percentage of firsts much less than at Thetford. The fibre is also for the most part shorter, and much of it, especially near the surface, is discoloured, probably from the percolation of surface waters charged with iron.

Although large areas of serpentine exist at various points in the townships above named, a great part of them are, in so far as explorations have extended, apparently devoid of profitable veins of good asbestos; in some, short-fibred veins of harsh and brittle mineral are found, but these have as yet no economic value, so that the really valuable areas are not very numerous. During the past season all the old mines were carefully examined, as well as the new openings being made during the year. Among these last may be mentioned the Megantic mine, one mile and a half from Coleraine station, first prospected in 1886, but now worked by Fenwick & Scater, of Montreal. A peculiarity of this mine, not noticed elsewhere so far, is the occurrence of considerable quantities of mica in veins with impure asbestos. The rock here is very much shattered near the surface and the fibre is consequently discoloured. Veins up to one inch and a half are found, and in the more solid portions the quality improves. The output from this place has been necessarily small, owing to the time spent in opening the mine and the delays from bad weather, the quantity mined in four months to October 1st being 39 tons, of which one-third may be classed as seconds, the rest as thirds. An average number of 12 men was employed.

Near Black Lake several openings have been made along the track of the Quebec Central Railway by Messrs. Johnston & Lomas. Only three to four men were employed, and the work was of a preparatory nature. The quantity of asbestos obtained was not stated. On lot 32, range B, Coleraine, work has been begun by Capt. Williams. At my visit in October the average number of men employed was 15, and the output to date 29 tons, of which $4\frac{1}{2}$ tons were firsts, the rest about equally divided between seconds and thirds.

In this district also the Bell Company began operations on the north half of lot 28, same range, formerly the Hayden property. Very good surface indications are here visible, many small veins showing, while in the cut

now going in towards the base of the hill fibre an inch and a half to two inches long of good quality is found. The south half of these lots 28 and 27 belonging to Dr. Reed, has lately been sold to the Wertheim's of Frankfort, Germany, who are putting in machinery preparatory to developing the mine. This property is the most elevated of any in the district, being not far from 600 feet above Black Lake Station. The surface indications are here very favorable, veins up to two inches and a half having been found. Prior to the sale about twelve tons were taken from this place, of which two tons were firsts, four seconds and six thirds. It is now being worked by contract at \$25 per ton, ready for market. On the north side of the Poudrier Road, in lots 27, 28, 29, range A, Coleraine, several openings have been made and good indications have been obtained. At the time of my last visit, veins of asbestos up to an inch and a half were seen with a number of smaller ones. On lot 26 also an opening in the surface of the hill disclosed small veins. These areas are separated from those of Black Lake proper, by masses of white granulite and dioritic rock, a belt of which closely associated with the serpentine extends from the shores of Black Lake to the rear of the Thetford mines.

In the township of Ireland on the west side of the great serpentine area, which extends north east from Wolfestown, King Bros. have started two openings on lots 24, 25, range 3. The elevation of these by aneroid is about 500 feet above the surface of Black Lake, which is 200 feet below Thetford Station on the Quebec Central Railway. The asbestos here is found principally in two knolls about one fourth of a mile apart, and occurs at times in a series of thin veins from one eighth of an inch upward, as many as twenty being sometimes found in a space of six inches. Many of these veins show a selvage of whitish weathering serpentine on either side, separated by a thin vein of asbestos from $\frac{1}{4}$ to $\frac{3}{4}$ of an inch thick. Other veins of greater size are numerous, ranging in thickness to $1\frac{3}{4}$ inches; the aspect of the rock and the veins at this place strongly resemble in many respects those on the Belmina property in Wolfestown. The surface indications in so far as visible are excellent, but the mine has not been thoroughly opened, only two months' work with a small force having been spent on it.

At Thetford, new openings have been made to the west of the Quebec Central Railway by Messrs. Ward Bros., by Mr. Johnston and by King Bros. These prove to a certain extent the serpentine area between the present workings and the Thetford river, and good indications of productive ground are found at all the locations, though the lower lying level of the ground may necessitate drainage works.

On lot 28, range VI, Thetford, good indications are found, as also on lot 32, R. C. Coleman, but no work has been done on either of these during the past year. Further north, on lots 16, 17 and 18 in range IV, Thetford, a belt of serpentine occurs which has been opened by Dr. Reed, who reports some very good veins of asbestos. Chromic iron, also, is found in this area, but the samples seen by us seemed too poor in chrome to reach the required standard. Noses of serpentine also occur on lot 13, range V, and on range XI, Broughton, from which asbestos has been reported, but, in so far as yet learned not in such quantity as to be economically valuable. The Broughton mine was also worked during the past season; the vein, of which there appears to be only one, in places reaches a thickness of 3 inches; at others it is split up into a number of thin strings of no

value. The returns from this mine have not been received.

The established mines in all the districts have been working during the past year, though the output has been greatly lessened by the very bad weather, especially during the autumn months. An attempt to obtain the output from each mine has been made, but has been only partially successful, several of the managers neglecting to forward the requisite information in time. Of the Thetford mines, the output of the Bell Company mine, formerly the Boston Company, still far exceeds the others. The shipments for the season to 1st December being 1,350 tons, of which 930 tons were firsts, 105 tons seconds, and the rest waste or thirds. The quality of the asbestos from all the mines of this district is excellent and the price obtained are even higher than quoted in the report of 1886; *seconds* in some cases command \$75 per ton and *firsts* from \$80 to \$110. The output from King Bros.' mine for 1888 was *firsts*, 170 tons; *seconds*, 165 tons; *thirds*, 24 tons. Average number of men employed 32 boys 20. The returns from the other properties are not yet in, but there has been great activity in them all, and the output has been correspondingly large. Rock drills worked by compressed air have recently been introduced at the Bell mine.

In the Black Lake district the principal mines in operation are the Scottish-Canadian the Anglo-Canadian and the D'Auville. Mr. Penhale, the manager of the Scottish-Canadian states that in the eight months ending 10th November, 400 tons were shipped from the mine, of which 40 tons were firsts, 110 tons seconds and 250 tons thirds; but operations were hindered by scarcity of men and bad weather, so that the new workings could not be carried on. This mine is equipped with improved machinery, air compressor, rock drills, hoisting engines and dumping skips, with a new set of appliances for crushing the rock and separating the asbestos, more particularly in regard to the lower grades, to avoid the great expense of cobbing by hand. This machine was in operation but a short time, but is claimed by the manager to be a great success. Should this be the case and the asbestos of short fibre be easily separated, it will largely enhance the profits of the industry, since many of the dumps, most of which now cover very valuable ground, can be profitably worked over and the refuse disposed of for ballasting or other purposes, while under the present system of hand-cobbing, the shorter veins do not warrant the expense necessary for their separation. The Anglo-Canadian mine for the six months ending 15th of November, produced, according to Mr. Hopper, about 210 tons, the average number of hands, including cobbers, being 30 to 35. The principal pit at the mine has been sunk to a considerable depth and Mr. Hopper reports veins at the bottom of very superior asbestos, resembling that from Thetford, from 3 to 7 inches thick. These veins have been uncovered since my visit. The percentage of firsts from this mine has, according to the manager, increased from 10 to nearly 20 per cent. Openings in the face of the knoll to the west of the principal pit are now being worked, the indications here being very good. The output of the Fréchette or D'Auville mine, which lies between the two just mentioned, is given by Mr. Hopper for the season to 1st December as about 300 tons.

The cause of the difference in quality between a great part of the output from the Black Lake mines and those of Thetford has long been a

*Summary Report of the Geological Survey of Canada to 31st December, 1888.

source of enquiry to the mine owners of those places. By some it is supposed to be due to the difference in level between the two places, the workings of the Scottish Canadian Co. being from 50 to 300 feet higher than those of Thetford. Yet this can hardly be taken as satisfactory, since at the Reed mine, 300 feet higher, some excellent fibre is found. A more likely reason may possibly be the driving off of the contained water in the fibre, since asbestos is a hydrous silicate of magnesia, by the action of diorites or the metamorphism preceeding from the presence of the granites, which occupy a considerable area of the Black Lake district. If the soft silky fibre is heated it changes its character at once and becomes harsh and brittle. The serpentine near the contact with the granitic veins or masses is often very considerably shattered as though the presence of the granite had exercised marked influence on its condition. At Thetford the granite masses in the mines are limited to small and thin dyke-like veins, which have not produced any great effect upon the asbestos, but must, however, be said that the stiff fibred mineral is not in all cases confined to the vicinity of visible granitic masses, and other causes may in such cases have produced a similar effect.

Practical Prospecting for Gold and Silver.

The following paper was read by Mr. James Brady, D. L. S., Victoria, B. C., at the annual convention of the Association of Dominion Land Surveyors held last month at Ottawa:

Surveyors in the practice of their profession have many opportunities of examining the rock formation, and ascertaining to some extent the mineral resources of various parts of the country, and, although many members of the profession and of this association are quite as well posted as I am on the above subjects, others may not have given them much attention, and will not object to a few hints that may assist them in determining when they are in a country that may be expected to produce gold, silver, or other ores how to search for the same in an intelligent manner; and how veins may be opened up, in a preliminary way, so as to ascertain as cheaply and quickly as possible the character, value per ton and probable production of ore, thus determining the nature of reduction works required, and being enabled to estimate the cost of mining and reduction plant necessary to work the mine to its full capacity and of the returns and profits that may be anticipated.

It is said that most of the great mines of the world were found by chance and not by regular prospectors. This is probably true as regards lodes and veins, but it must be remembered that until within very recent years the average miner or prospector had little or no knowledge of the rock formations in which gold, silver and other metalliferous veins were likely to be found, and simply roamed over the mountains in a haphazard way, and was as likely to look for gold quartz in cretaceous limestone as in metamorphic slates, or to follow the wrong formation longitudinally as to cross it and get into a better one.

One instance, however, may be mentioned where intelligent observation and persevering search led to the discovery of immense gold fields and the settling up of a great continent—namely, the discovery of gold in Australia by Hargraves in 1851.

Nothing will build up a new country so rapidly as the discovery of gold and silver

mines. Agricultural and manufacturing enterprises are of slow growth, no matter how fertile the soil or how excellent the facilities for successful operation, unless they are given an impetus by something such as the discovery of gold or silver, which will cause an immediate influx of population. When such a rush occurs as is generally the case on the first opening up of a new mining country the work of exploring and development goes on rapidly, and all the resources of the country are developed in a proportionately rapid manner. Lumbering, farming and stock raising enterprises spring at once into existence, as the mines furnish a ready market and good prices for their products.

The old pioneer prospector is rapidly disappearing, and organized prospecting and exploring parties, under the direction of competent mining engineers and experts, are taking his place; and this manner of acquiring mineral properties will be largely adopted in the future as being the cheapest and in every way the most satisfactory manner of gaining possession of valuable mining rights.

The head of such a party starting out to prospect any particular range of country would first acquaint himself with all the geological and other information to be had from the reports of the Geological Survey and other parties who had visited the region of his intended exploration. Failing such sources of information he would take such reports and evidence as he could find relating to the mineral resources, etc., of other districts on the same geological belt or mineral zone, and thus get some idea of where to look for the particular class of ore or mineral desired.

The following extracts from an article on "Mineral Zones and Mountains," from the *Mining and Scientific Press* will help to explain this point:

"One of the plates accompanying King's Exploration of the 40th Parallel is a section of the Warren map of the U. S. Engineer Department. The section given includes the main central region of the great basin, with a part of the coast system of California, and the outlying chains of the Rocky Mountains. A brief study of this map will teach the *one great and prominent law of arrangement of Cordillera Mountain chains, namely, that they trend from north to south, or from north-west to south-east.*"

"In strict subordination to this longitudinal direction of ranges," says King, "are grouped all the structural features of local geology. The average strike of the great areas of upturned strata is generally with the meridian. All the larger outbursts of granitic rocks conform to it as well, since their rents are most commonly the axial lines of actual folds; and, lastly, when the tertiary uplift occurred, its ranges bordered the older mountains in parallelism, and the volumes of lava accompanying it found exit through longitudinal rents, and either built themselves up along the ancient line of structure or through new fissures piled up chains of volcanoes conforming in trend with the general north and south plan."

"Over these mountains are found localities of the precious metals, and it is not surprising to observe that, following its leading structural idea, they appear to arrange themselves in parallel longitudinal zones."

1. "The Pacific coast ranges on the west carry quicksilver, tin, and chromic iron.

2. "The next belt is that of the Sierra Nevada and Oregon Cascades, which upon their west slope bear two zones; a foot-hill chain of copper mines, and a middle line of gold deposits. These gold veins and the resultant placer mines

extend far into British Columbia and Alaska.

3. "Lying to the east of this zone, along the east base of the Sierras, and stretching southward into Mexico, is a chain of silver mines containing comparatively little base metal, and frequently included in volcanic rocks.

4. "Through middle Mexico, Arizona, middle Nevada and central Idaho is another line of silver mines mineralized with complicated association of the base metals, and more occurring in older rocks."

5. "Through New Mexico, Utah and Western Montana lies another zone of argentiferous galena lodes."

6. "To the east again the New Mexico, Wyoming and Montana gold belt is an extremely well-defined and continuous chain of deposits."

From this it can be seen how any information relating to the geological structure and rock formation of a district, or the character of its ores, will assist in determining what may be expected at other points in similar respective positions, on the same range. As an illustration of this I may mention the fact that on the Selkirk range in Kootenay District, B. C., large and valuable lodes of silver bearing lead and copper associated with other base metals, have lately been discovered. The ores of this district correspond in character with those of Idaho and Western Montana, immediately south and on the same range, and with those of mineral zones 4 and 5.

It being a fact that nearly all the valuable gold-bearing veins of the world have been found in metamorphic slates and schists of different ages, from the Silurian in Australia to the Jurassic in California, it is more reasonable, and one is more likely to prove successful, in searching for gold, to confine one's explorations to metamorphic rocks. In like manner all the great gold placers, being chiefly composed of sand, clay, gravel and boulders derived from these and allied rocks, it seems reasonable to prospect for gold placers on the lower slopes and benches of mountains and hills composed of such rocks (particularly where traversed by many quartz veins) and on the rivers and streams draining a country of the above character.

Gold-bearing lodes may be looked for in quartz veins traversing and interstratified with the the softer metamorphic crystalline rocks, such as argillaceous, chloritic, talcose and hydromica slates and schists. Also to a much less extent in granite, gneiss and the harder metamorphic rocks.

The minerals or ores commonly associated with gold, in quartz veins, are iron, copper, lead and zinc sulphurets, and sometimes tellurium; the presence of one or more of these, being considered a good indication in a gold country; and their entire absence as unfavorable to the permanency and regular yield of the lode—even though free gold may be visible in the quartz. The most permanently productive gold quartz mines have been those in which free gold was seldom or never seen, and the above sulphurets were more or less represented.

The quartz is frequently rusty or cellular, and discolored brown, yellow, reddish, blue, etc., by the decomposition of the base ores accompanying the gold.

The most certain and reliable way of finding out if a quartz vein carries gold in paying quantities is to pound up pieces from different parts of the vein and pan them out. If the quartz is pounded very fine and then carefully washed down in a pan or horn, fine particles of gold will be found and can be seen with the naked eye, if there is sufficient in the quartz to pay for working; and it is not worth while

spending much time over a vein (as a gold vein) unless colors can be found in that way. Of course gold is found in paying quantities associated with ores of silver and other metals, as in the Comstock lode, where its presence cannot be ascertained by simply panning out; but this really comes under the head of silver ore, and will have to be assayed in a similar manner.

Veins and streaks of solid arsenical and other pyrites often carry gold in what would appear to be paying quantities, but such mines have seldom been worked successfully.

Silver and its ores are so intimately connected with many of the ores of lead, copper, antimony, zinc, etc., that in indicating the rocks in which we may expect to find silver-bearing veins we necessarily include the others.

Native silver, ruby silver, and silver ores proper, such as are mixed with base metal ores to only a limited extent, are found most frequently in syenite, trachyte, andesite, porphyry, gneiss and allied metamorphic rocks, and in shaly sandstone, conglomerates, etc., in the vicinity of eruptive rocks, and generally in a quartz gangue.

Argentiferous galena, and carbonate of lead carrying silver, argentiferous grey copper ore, etc., in argillaceous shale and schists, crystalline limestone, etc., and porphyry. And low grade argentiferous galena and carbonates in carboniferous and other limestones.

The vein matter, or gangue, may be quartz or calcspar, or both, and may be mixed with heavy spar, flour-spar, or pearl-spar, and in some of the largest and most productive lodes the vein matter is chiefly yellow or brownish clay with boulders of iron manganese rock, and horses of the country rock, and in this character of gangue the largest chimneys of galena and carbonates, carrying silver, have been found.

The character and value of silver ores cannot be accurately determined except by regular assay. They are mixed with so many other ores and minerals that in many cases they cannot be distinguished from the ordinary ores of the base metals. After long experience a man may be able to form a fair estimate of the ores of the particular district in which he has been working, but take him into a new district, where the combinations are different, and his opinion as to the value of an ore, from simple inspection, is quite worthless.

A collection of small specimens of different metallic ores, which can be obtained in New York and readily carried along, will be of some assistance, and with a blow-pipe outfit tests which will determine at least the presence or absence of silver and many of the other metals can be made. These, with "Dana's Manual of Mineralogy," an elementary treatise on geology, and a book of instructions for the use of the blow-pipe, a gold pan or horn and a bottle of nitric acid will enable one to get a fair idea of any ore, rock or mineral, he may come across.

A pick and shovel, hand-crushing machine or pestal and mortar, and one or two rock hammers and small prospecting poll picks should be carried along; and on regular prospecting expeditions, where such things can be packed or carried, a small bellows and anvil, drills, striking hammers, powder, fuse, caps, &c., should form part of the outfit.

In prospecting a given belt of country it is best to cross it as often as possible, and where the rock formation is most exposed, following up the beds of the streams where practicable, and making lateral excursions at convenient points and where the formation seems favourable.

At or near a change of formation, say from slate to granite or limestone, and near porphyritic

or other igneous rocks, in stratified or metamorphic beds, large and productive lodes may be looked for.

Large veins are generally split up or divided into several branches in the valleys or crossings of streams, but the large and solid outcrops can generally be found on the high ridges on either side by taking the general direction of the veins at the crossing, and it is usually on these ridges or hills that the largest and most valuable deposits of ore are found.

Preliminary development.—The first thing to be done in opening up a lode is to ascertain the extent of the ore-body on the surface, so as to determine the best place for a shaft or tunnel. This can be done by sinking to bed rock at several places along the general line of the lode where it is not already exposed, and making cross-cuts at these points. If the mine is to be opened up by means of a shaft it may be located about the centre of this ore-body, and should follow the vein down. The dip of a vein is so liable to change near the surface that a perpendicular working shaft cannot be properly located until prospecting works have been carried to a depth of at least 200 or 300 feet. Drifts or levels should be run about every 60 feet, and where the vein is wider than the drift, cross-cuts should be made at about the same distance apart. The extent to which this work should be carried and the size of shaft, &c., must be determined by the nature of the vein and its ore, the developments made in sinking and drifting and the amount of money the manager has at his command for this purpose. A shaft from 200 to 300 feet deep, and drifts as above, say 120 feet on each side of the shaft, with cross-cuts about every 60 feet, will generally be considered sufficient to decide the probable value of the property and the cost of mining and reduction works for permanent operation.

The ore taken out of the shafts and drifts will help to pay for the work, and the mine will be in a condition to put on men enough to stope out ore while reduction works are building to keep them running while the permanent shaft is being put down.

If the vein crops out on a side hill, or bluff, so that a tunnel can be run along the vein, at a sufficient depth from the outcrop on top, much time and money can be saved, and both hoisting and pumping works dispensed with. But if the strike of the vein is such that the tunnel must be run any distance through country rock before encountering the vein, it must be prospected and proved to a sufficient depth before a tunnel can be attempted without great risk of miscalculation and disappointment.

In lodes that are not too wet, rock and water can be hoisted for the first 100 feet by windlass and from 200 to 300 feet by a whim; but where much water is encountered an engine will be required.

The following points in relation to mining claims should be carefully noted:

1. Location or position on the map.
2. How to reach it, and condition of roads, trails, etc.
3. Course or strike, width and dip of vein or lode.
4. Class of ore or mineral, as nearly as can be ascertained.
5. Quality of ore or mineral, and samples if possible.
6. Length or width of ore body exposed.
7. Gangue or matrix of vein.
8. Character of walls.
9. Country rock.
10. Water-power, if any, fall, number of inches, etc.

11. Quality and cost of wood, timbers and lumber.

12. Cost of labor and board.

13. Price of provisions, grain, hay, etc.

14. Rate of freight from nearest railway station, steamboat landing or town.

15. Distances from nearest railway station, steamboat landing or town.

16. How lode is situated for development by tunnel or shaft.

17. Distance and freight to nearest smelter or reduction works; and rates paid for ore or charged for reduction.

18. Remarks on climate, labor, supplies, grass, etc.

19. Sketch of claim and surroundings.

In closing this paper I will quote the following from a report of the Legislative Council of Victoria, Australia, March, 1854:

"The discovery of the Victoria gold fields has converted a remote dependency into a country of world-wide fame; it has attracted a population extraordinary in number, with unprecedented rapidity; it has enhanced the value of property to an enormous extent; it has made this one of the richest countries in the world, and in less than three years it has done for this colony the work of an age, and made its impulses felt in the most distant part of the world."

Knowing the immense results that have followed the opening up of mines in Australia, California, Nevada, Montana, etc., one would suppose that our Government (both Provincial and Dominion) would offer every inducement to prospectors and miners to prosecute their work of exploration and development instead of hampering them with unnecessary and harassing rules and regulations. The mining laws of all the provinces, and the Dominion, should be assimilated, and many alterations made, and mining machinery which cannot be or is not manufactured in Canada should be admitted free of duty, at least until such time as we can manufacture it ourselves.

The Treatment of Ores.

(Mining Journal.)

II.—Silver Milling.

The ores of silver suitable for treatment by the milling process may be divided into two classes, according to their chemical compositions—viz.: (1) Free milling ores, or those capable of being treated without a preliminary calcination or roasting, and (2) ores which require roasting before amalgamation. The ores suitable for treatment by the free milling process are those containing the precious metal in such forms as are acted on by quicksilver directly, or by the aid of reagents. Ores containing silver in a metallic form may be treated by direct amalgamation, as in the case of free milling gold ores. Other ores of silver best adapted to this process are those containing the metal, as chloride, as kerargyrite, or horn silver, bromide, iodide, and various combinations, with sulphur, whilst in South America ores containing antimony and arsenic are worked by the process, but the sulphides of these base metals, and those of iron, copper, zinc, and lead, if present in considerable quantities, seriously interfere with the process by the fouling or "sickening" of the mercury, and by their reactions on the chemicals employed. The operation is usually performed in amalgamating pans. The process in any case is a slow one and is, generally speaking, only suitable for the treatment of decomposed ores,

or those containing silver in a very free state. Its adoption to the treatment of refractory ores is confined to districts where the cost of fuel is too heavy to permit of roasting-milling. The cost is very high, varying from 40s. to 80s. per ton, besides a lot of silver amounting to from 5 to 20 per cent. of the contents. Roasting-milling is employed on ores containing large percentages of the base metals. Such ores are crushed dry and roasted with salt previous to amalgamation in pans as in the case of free milling ores. The process is rendered more costly than free milling by the additional expense of dry crushing, and the use of the extra agent. Dependent upon local circumstances, the cost may vary from £2 to £5 per ton, but the loss of metal is with careful manipulation only 10 to 15 per cent. of the contents. Where the ores contain zinc, however, the loss would be considerably higher.

III.—Lixiviation.

Under this heading is included several methods of extraction of silver from its ores by the conversion into soluble chloride or sulphate, which is dissolved by water, a solution of common salt, or by other suitable solvents, the silver being recovered by precipitation instead of amalgamation with mercury, as in the free milling and roasting-milling processes. The wet methods are less costly and more rapid than the amalgamation process, but require more skill in working them, especially in the calcining stage. Ores suitable for these processes should not contain large quantities of lead, zinc, antimony, or arsenic, while the presence of either cuprous, sulphide, or iron pyrites is necessary to produce the reactions of the roasting stage. The great skill required in this stage of the process militates against the adoption of the process except in well appointed metallurgical works. The cost varies from £3 to £6 per ton, or even higher where the quantity of ore treated is small, but the loss is comparatively small.

IV.—Concentration.

Whatever process may be most suitable to a given description of ore, a preliminary treatment in many cases will be necessary to remove the gangue and earthy constituents of the ore. The degree to which this concentration should be carried depends upon the nature of the gangue, the characteristic distribution of the metallic portions, and the process which has been selected for the subsequent manipulation of the ore. Under these classifications concentration may be divided into two classes—fine and coarse concentration.

Coarse concentration is applicable to ores in which the heavy minerals, such as those of lead, zinc, iron, and copper, are distributed in masses through the gangue, and in which a rough concentration is sufficient to separate the mineral. The ore is first crushed, and afterwards sized by passing through a series of graduated sieves, and as the success of the operation depends in an absolute degree on the perfection of this classification too much care and attention cannot be bestowed on it, each size being treated on a separate "jig." The "tailings" or waste from the jigs frequently contain particles of ore with mineral attached which has not been detached in the first crushing; such tailings should be re-crushed, but the thoroughness of the operation in this respect would naturally be regulated by the margin of value contained in the imperfectly crushed ore after allowing for the additional cost entailed by re-crushing. The slimes require to be treated by distinct machinery, such as revolving buddles, as employed on tin ores in the Cornish mines; by Rittinger tables; or by the more modern "vanning" machines of Amer-

ican invention. Slimes which have been enriched by the addition of brittle minerals of the precious metals, occurring with the base metals, such as ruby silver ore, and various tellurides, will require extreme care in their manipulation. To prevent loss in dust, wet crushing should in all cases possible be adopted.

Fine concentration will be necessary in all cases where the mineral is disseminated in fine particles throughout the gangue rock, and where coarse crushing is inadequate to separate the mineral. As in the case of slimes from coarse concentration, machines adapted to the treatment of pulverized ore are necessary, the most common being revolving buddles, Rittinger tables, or vanning machines. Ores containing galena, blende, silver glance, tellurides of gold and silver, grey copper, iron, and copper pyrites in fine state of division may all be successfully concentrated in this way, with the exercise of care. The process is suitable for low grade silver ores, provided they are not chlorides, or decomposed ores, which are best treated by the free milling process. It is not adapted, however, to carbonate ores where the mineral is disseminated in fine films or mere discolorations through the rock. In the Lake Superior district silver ores containing only 6 ounces of silver to the ton are profitably treated, and the concentrates shipped 600 miles to a smelter.

The subsequent treatment of the products from either coarse or fine concentration must depend on the description of ore operated on, but in most cases where smelting facilities are within reasonable distances it will be found preferable to send the ore to the smelting establishment.

Transmission of Power Through a Bore-Hole.

Mr. Wm. Hall, Manager of the Spring Hill (N. S.) mines, gives the following account of the successful completion of a winding plant, situated on the surface, and hoisting from an underground slope:

One of the most noteworthy improvements made at Springhill collieries for some time past is the successful introduction of a new system of underground haulage, for winning coal.

To place engines underground has always been a source of annoyance and danger to the workmen. The air is excessively heated, and the roof more or less affected, sometimes disastrously by reason of the hot air, and escaping steam operating upon the air courses, where there is fire-clay, loosening it so that there is pieces falling continually.

The North slope is sunk 800 feet down to the working levels. From this slope from seven to eight hundred tons of coal are raised daily.

This seam of coal has also been tapped 500 feet to the deep of the North slope, by means of a tunnel driven through the intervening strata, between the north and south seams, a distance of eight hundred feet. This tunnel was started from the 1300 foot level in the West slope. The coal from the 500 foot lift in the north seam will be taken through this tunnel and hoisted up the West slope.

A bore-hole four inches in diameter has been put down from the surface to the bottom of 1300 foot level (North slope) a depth of 600 feet perpendicular. An engine and boiler have been placed in position on the surface close to the bore-hole. Power is then transmitted by means of a wire rope, and an arrangement of pulleys at the top and bottom of the bore-hole. Beside the wire-rope in the bore-hole is placed

a signal cord. By means of this cord communication is kept up between the engine-men and the man at the bottom.

A slope which is to be 750 feet deep has already been started on the 1300 foot level at the bottom of the bore-hole. It will be sunk at the rate of 200 feet a month. The coal taken out of this slope will also be brought through the tunnel previously mentioned, to the West slope. When the slope is completed and opened out, the coal will be hoisted up the North slope to the surface a distance of 2,000 feet.

This method of working coal will enable a large body of coal to be won twelve months earlier than it could possibly be done under the present circumstances. The placing of an engine on the surface obviates the conducting of steam in pipes a long distance, with all its attendant injurious effects upon the workings. The mine is kept perfectly free from hot air and steam.

The first cost of the bore-hole is not nearly so great as that of 1800 feet of steam pipes, while the cost of repairs, where pipes are suspended from the roof by means of hooks, will be entirely saved. Other repairs necessary to prevent leakages in the pipes will also be obviated, thus effecting a very material annual saving.

This I believe, is the first experiment of the kind in Nova Scotia—or in the Dominion.

Canadian Asbestos Co.

Many Canadian and American capitalists are interested in the affairs of the Scottish-Canadian Asbestos Company. The company has been in liquidation in Scotland for some time and periodical cablegrams marked the progress of proceedings. A notice was published in Scottish, Canadian and American newspapers, calling a meeting of all creditors and contributories of the company at Arthabaskaville, at 2 o'clock on Tuesday the 19th instant. An impression appears to have been formed among American and Canadian stockholders that an old country clique was formed to gain control of the mines. Mainly owing to mismanagement the affairs of the company have been in a bad state for some time. A few of the English creditors came to an arrangement with the company's directors whereby they advanced \$15,000 for the working of the concern. By this means they aimed at securing predominant influence, and standing for a privileged claim and a guaranteed interest-revenue from the proceeds of the works. Then they put the company into insolvency. The notice advising intention of this action only reached this country after the Scottish courts had granted the petition and appointed curators.

The meeting of creditors called for 19th inst. was to have discussed the position of the corporation. Mr. Guerin, of Messrs. Greenshields, Guerin & Greenshields, went out to Arthabaskaville on behalf of a number of Canadian and American creditors, representing some \$195,000 of the company's stock. He was instructed to fight the petition for putting the concern in liquidation, but the judge before whom the case was to come was sick at home and no court could be constituted. Attorneys for the liquidation party asked Mr. Guerin to register an appearance, but he would not, so that now the case in forensic phrase "by the intervention of Almighty God" is quashed. During the six or more weeks it will take to bring forward the case again, all proceedings having now to be gone over again, Mr. Guerin and his clients will have time to prepare a definite line of action.

PHOSPHATE.

In General.

A good deal of interest has been awakened in England in the Canadian phosphate industry and if judicious selections of properties are made the investment of capital will redound to the benefit of both countries.

Market.

Canadian phosphates appear in good demand abroad, and the market may be quoted at 9d. for 70%, 10½d. for 75%, and 11½d. for 80%, all with one-fifth per unit rise.

Du Lievre.

On going to press, we learn that the properties of the "Société de Phosphates de Canada," in liquidation, have been suddenly acquired by European capitalists. The property comprises some 5,000 acres of phosphate lots, chiefly in Portland West, and of which the Baisson group is acknowledged to contain a rich deposit.

Reports concerning the North Star continue to be exceedingly satisfactory. A splendid show at the No. 2 pit (the only one at present being worked) is yielding regularly and easily 800 tons per month with few men. The completion of the new wharf under construction will probably be retarded by the early collapse of the river road for sleighing.

The output of the High Rock mines for the month of February is reported to have been fully 1,000 tons; this is a record for these mines. Ample preparation is being made for a busy season.

There is nothing special to report from the Emerald or Little Rapids mines.

At the Canadian Phosphate Co.'s mines, the Beaver Meadow boiler house was totally destroyed by fire on the 5th instant. The loss, however, has caused no serious delay of the works, for the energetic superintendent, Mr. Lainson Wills, had the engine running before noon on the following day, and a new house constructed in twenty-four hours. The new car track has been kept running without difficulty all through the winter. The pier at Crownhill has been completed, and by appearances may be taken as a model of an inexpensive and yet efficient means of readily loading the scows. Six tenement houses and a general house for manager, and office, will be immediately added to this part of the company's property. Two new scows are also in construction. The various pits are all looking well.

The winter which closed up so unexpectedly in this place, promises to give an equal surprise for early navigation. Those who have their ore above the Little Rapids may well have some anxiety on the score of getting their scows past this obstructed part of the river should not the Provincial Government render some assistance. It is evident that something in the shape of a steam winch on float will be required to draw the scows up the channel. We would suggest that the miners organise and send a deputation

to Quebec to insist that something should be done to facilitate the shipment of ore at this point.

Mr. C. W. Spencer, Assistant Superintendent of the C. P. Ry., visited Buckingham on 21st to meet the representative of the phosphate and mineral companies with a view to having more satisfactory means of transshipment from the scows into the cars than at present exists. As pointed out in our last issue there is an urgent necessity for the erection of elevated bins and extra sidings to meet the requirements of the industry.

Templeton District.

Mr. C. Lionais, formerly superintendent of copper and asbestos mines in the Eastern townships, is reported to be making elaborate preparations for commencing work on some lots adjoining the Blackburn estate. Telephone communication to the station, electric light and a costly plant is said to be in course of erection. Perhaps it might be well to ascertain and prove the true value of the property before going to all this expense. Extravagance and illadvised management has in the past wrought enough harm to our Canadian mines, as a number of properties with which Mr. Lionais is not unacquainted can testify.

Mr. Robert Blackburn informs us that the new works at his mine continue to progress satisfactorily.

The Templeton & Blanche River Company are negotiating with English people for the transfer of their property.

Perth District.

The Anglo-Canadian Phosphate Co. report a continuance of the favorable operations at Otty Lake and Bobb's Lake mines, and will have about 1,500 tons of phosphate ready for shipment at the opening of navigation. It is expected that the force of miners will be largely increased after the spring thaw is over, as several deposits have been opened.

Kingston District.

J. Foxton, of Sydenham, has fifteen teams hauling phosphate down to the lake. Notwithstanding the inclemency of the weather, 100 tons were laid down last week. The mine still looks remarkably well; the more depth attained the larger the body of apatite.

Remarkable progress of a South African Gold Mine.—The hitherto comparatively unexplored district of Witwatersrandt having been prospected is now producing results as sensational as were experienced in the days of the Australian gold fever, and those results will evidently be supplanted when enterprising speculators have gone further afield. During the past year no fewer than fifteen hundred stamps have been laid down at Witwatersrandt, thus bringing up the total number to two thousand; and further extensive engineering works are being carried out to meet the exigencies of a development in mining that is truly phenomenal. A sufficient illustration of this development is found in the yield of the Robinson mine, which, with a ten-stamp battery, had a crushing in November of four thousand ounces. It can, therefore, give rise to no astonishment that a 20s. share in this mine has now reached the extraordinary value of £64. Such a figure is, of course, exceptional, though the shares of other companies command a very high premium.

MINING NOTES.

We shall be greatly obliged to mine owners and superintendents for such authentic reports of their operations as may concern shareholders and the public.

Nova Scotia.

NOTICE.

At the Annual Meeting of the Gold Miners' Association of Nova Scotia, held at Halifax, on 6th instant, a resolution was passed adopting the "Canadian Mining Review" as the official organ of the Association. Our readers may therefore rely upon the accuracy of all information published in these columns bearing on the gold mining industry of the Province.

The annual meeting of the Gold Mining Association of this province was held at the Halifax Hotel, Halifax on the afternoon and evening of Wednesday, 6th March. A large amount of business was transacted, and some important changes in the by-laws were made. The retiring officers were re-elected but as these gentlemen declined to take office again, a fresh ballot was taken with the following result: President, B. C. Wilson, Waverley; Vice-President, G. W. Stuart, Truro; Secretary-Treasurer, J. H. Townsend, Tangier; Committee on Publication, Messrs. J. E. Hardman, T. R. Gue, John McGuire; Committee on the Mining Law, Messrs. F. B. Wade, J. M. Reid, J. H. Townsend. It is gratifying to note that the membership is growing rapidly and a Bill to incorporate the association with a capital of \$10,000 is now before the Provincial Legislature. The association meets a long felt want in the province and it has thus far had a very considerable influence for good upon the industries.

Darr's Hill District.

The Dufferin mine was sold at public auction in Halifax on the 14th. It was knocked down, after spirited bidding, to Peter McGregor Archibald for the sum of \$141,000. Mr. Archibald bought the property for a syndicate comprising A. K. Archibald, the Administrators of the estate of the late Capt. E. Archibald, Timothy Archibald, G. A. Leslie, Annie Dixon, widow of the late Henry Dixon, and George W. Stuart (all of whom were previous owners) and Gardner Clish, of Truro, N. S. The sale was therefore virtually that of the one-quarter interest hitherto held by Charles F. Mott, of Halifax, N. S. The syndicate contemplate incorporating as a stock company at an early date; meantime work at the mine is going on continuously.

Moose River District.

The new water-power stamp-mill erected for Mr. D. Touquoy has been crushing for ten consecutive months and gives entire satisfaction. The product for February was about \$1,700. Mr. Touquoy continues to crush his surface gravel and boulders with uniform results and with a profit. The material averages \$1 per ton in gold, and the total expense of handling and treating the same varies from 35 cents per ton in summer to 40 cents per ton in winter. The supply of this material is said to be very large. Mr. Touquoy is also working a lode yielding about one-half ounce to the ton.

Oldham District.

Work on the Standard Gold Co's. property is being pushed this month. A new level has been started to the east at a depth of 350 feet and the corresponding level will be commenced as soon as possible. Slopes 12 and "B" are working with a full compliment of men, and the main shaft has been cleaned out preparatory to sinking. The east shaft has now a total depth of 368 feet, and the quartz in the bottom looks better than at any other point below the 350 foot level.

The Oldham Gold Co. have stopped work in their No. 3 shaft, Baker Vein, owing to the poor prospects held out by the work already done. The vein seems to have pinched out altogether in the bottom of this shaft. In No. 5 shaft but little work is doing, the vein here being only a seam. Only the 400 foot level south, and the 275 foot level south being worked. No stopping has been done for some months on account of the low grade character of the ore so far met with.

Renfrew District.

The manager of the Empress Gold Mining Co. expects to drop ten stamps in the new mill within a month; the other stamps will not be put in just yet. Considerable quartz is on the dump, and a large amount broken below. The shaft is down about 300 feet, but is not now sinking. The average of the ore is said to be about \$12.

On the Free Claim property development work is being pushed. From the shaft on the Brook lode a cross-cut is driving to the south, which has already cut three lodes, one of which shows well in free gold. A level is being driven on the lode preparatory to stopping overhand. There is a large amount of ground opened up on the Brook lode, and stopping has been already begun.

The example of the manager, Mr. E. C. McDonell, in adopting the system of driving levels and back-stopping is worthy of imitation by all our gold miners, and in this particular case we can see the effect of a little leaven "which leaveneth the whole mass."

Waverley.

The work of widening and retimbering the 360 foot shaft on American Hill is slowly but surely progressing. About 260 feet have been timbered to date leaving only 100 feet more before active sinking operations can be commenced. The surface plant is said to be the finest in the gold districts of the Province.

Crow's Nest.

A small amount of prospecting is going on at this mine, and the owners propose to do considerable development work this summer. The property geologically is an exceedingly interesting one, and its advantageous position for cheap extraction is rarely surpassed.

Pictou and other Districts.

The coal trade in Pictou County is at present in a more depressed state than it has been at any time since the close of navigation. This is more or less general at all the mines with perhaps the exception of the Black Diamond, at which a steady local trade is as usual being carried on. At this place the work of driving the drift through hard rock to the underlying seams is still pushed forward with vigor.

At the Acadia Colliery there has lately been a great deal of broken time but most of the workmen are retained, and they get a fair share of what work there is.

The depression is perhaps more keenly felt at the Drummond Colliery, and in consequence a large number of men are out of employment. There is, however, quite a number of hands regularly employed, and the number is being increased whenever circumstances will permit.

The operations carried on just now are entirely of a preparatory nature, rendered necessary by the adoption of a different method of working the new lift that is being rapidly opened up to meet the requirements of the summer trade.

At the Albion Collieries mining operations are also affected. The important re-opening of the works so frequently referred to in these columns is still being pushed forward with a determination well worthy substantial reward. Your correspondent hopes to report at early date that the long closed pits have been successfully opened and worked.

Rumors of the starting of the much talked of iron works have so long been rife that little or no interest is now taken in any report that is heard. It is difficult to understand why some kind of works have not been put up long ago in such a favorable locality, unless it be that capitalists hesitate to invest in consequence of the poor success of the steel company at Londonderry.

The following official statement shows the revenue derived by the Province from coal royalties during the past three years :-

	Cape Breton.	Cumberland.	Pictou.	Other Counties.
1886	\$44,210.80	\$30,534.90	\$26,894.38	\$16.45
1887	64,066.82	31,391.82	24,211.52	....
1888	63,608.45	28,309.36	32,853.75	4.50
SUMMARY.				
Total Revenue, 1886.	\$101,656.53			
" " 1887.	119,670.16			
" " 1888.	124,776.06			

The revenue obtained from other sources has been :-

	1886.
Prospecting Licenses	\$ 8,896.72
Rents (Leases).....	3,794.00
Gold Royalty.....	8,550.16
Licenses to Search	2,980.00
Coal Royalty.....	101,656.53
Licenses to Work	500.00
Renewals of Coal Leases	479.00
	\$126,856.91

	1887.
Prospecting Licenses	\$ 10,567.66
Rents (Leases).....	4,268.00
Gold Royalty.....	9,420.77
Licenses to Search	2,560.00
Coal Royalty.....	119,670.16
Licenses to Work	1,025.00
Renewals of Coal Leases and Fees.	945.70
	\$148,457.29

	1888.
Prospecting Licenses	\$ 9,571.49
Rents (Leases).....	4,720.50
Gold Royalty.....	8,612.41
Licenses to Search	3,940.00
Coal Royalty.....	124,776.06
Licenses to Work	1,275.00
Fees.....	371.03
	\$153,266.49

Cape Breton.

Dr. E. D. Peters, jr., left Boston on the 13th inst., in company with General Manager Gragg of the Eastern Development Company, to visit the property of the company in Cape Breton. During the trip, Dr. Peters will arrange the final details of his plans for the smelting works of the company, on the large scale which the development of the mine seems now to fully warrant. The last reports from the mine show the work in ore body to be progressing well;

main shaft 226 feet, and the slope on vein B now 44 feet, and holding the same breadth from the bottom. The south cross-cut is now passing through strongly mineralized rock.

Quebec.

Mr. E. Wertheim has returned from Europe and is at present at his asbestos mine in Coleraine. The results of the work done during the winter have been very satisfactory, although only a small force have been at work. Mr. Wertheim is making preparations for enlarged operations to be commenced as soon as the snow leaves the ground.

Mr. W. H. Walker is making many improvements on his graphite property, near Buckingham. Several substantial new stone buildings have been put up, and everything is being put in good shape for the recommencement of mining operations.

The Excelsior Copper Company's mines are reported to be working to the satisfaction of the owners. We understand that the shipments are fairly regular and of good quality.

The Thetford Asbestos Mining Company are applying for letters of incorporation. The capital stock is placed at \$20,000, the number of shares, 2,000 of \$100 each. The names and addresses of the applicants are: Arthur H. Murphy, Montreal; John T. Wilson, of Montreal, merchant; William S. Patterson, of Montreal, merchant; Robert W. Patterson, of New York; Henry C. Eno, of New York, physician, and John C. Eno, of the city of Quebec; of whom Arthur H. Murphy, William S. Patterson and John C. Eno are to be the first directors of the said company.

Mr. A. M. Evans, M. E., Cardiff, Wales, of the well known firm of Blakemore & Evans, has sailed for Canada. He is interested in asbestos and antimony in the Eastern Townships.

Ontario.

The Wahnapiatae Mining Company will put in some machinery at their Sudbury properties, and do preparatory work as soon as the snow leaves the ground.

Preparation is being made to open up and work the Guinea gold property, in the township of Kaladar. The owners are: Dennis Guinea, John Guinea and A. P. Wickware, of Kaladar; Rev. Father O'Donoghue, Erinville; F. Burrows, H. M. Deroche and J. H. Downey, Napanee, and R. A. Helliwell, of Chicago. A crusher has been completed and a large quantity of ore hauled out already for use. Thirty tons of ore will be crushed per day, and it is expected the yield will be from \$7 to \$10 per ton, or even \$15 per ton.

As announced in another portion of the REVIEW, it may be taken for granted that Ottawa will be the meeting place in October of the American Institute of Mining Engineers. A large and influential committee is being organized to carry out the arrangements, towards which the Federal Government and the Provincial Legislature of Ontario have made grants of \$1,000 each. An effort is being made to secure a similar sum from the Province of Quebec. It is also proposed to raise an additional \$1,500 by private subscription.

It is reported that American capitalists are organizing a syndicate to convey gas to Detroit from the gas well recently discovered at Kingsville. The reports from the new well are said to be satisfactory.

Port Arthur District.

The Provincial Government has decided to aid by a grant the proposed Port Arthur smelting works. This has given great satisfaction to the miners.

The Government has also granted a bonus of three thousand dollars per mile for fifty miles to the Ontario and Rainy River Railway Company. It is thought that this will make certain the construction of a railway through the rich mineral country west of Port Arthur, satisfy Fort William, and give general pleasure to the whole district.

The Supplementary Estimates contain a grant in aid of the Whitefish Valley wagon road.

Owing to our Correspondent's letter having miscarried we regret to be unable to furnish our usual budget of news from this region. All the mines however are working briskly, and yielding satisfactory outputs. A number of rich strikes, particularly at Silver Mountain, are reported.

Developments on "Silver Wolverine" so far consist of two openings, Nos. 1 and 2 shafts, the former being down to date, 20th ult., to depth of 42 feet from collar. This work has been carried out by contract labour. The location is traversed by two strongly defined and well mineralized lodes, the gangue of which is chiefly composed of flour, calc, quartz and heavy spar, carrying in addition to leaf and black silver the usual argentiferous black blende and fine grained argentiferous galena peculiar to this district.

No. 2 shaft is but partially opened on outcroppings of vein at a point 600 feet east to No. 1, and on the same lode, and so far as development has gone in this direction the vein matrix is of the same class as No. 1.

From collar to bottom both walls are well defined and slickensided throughout. Trap however to the 40th foot has been the prevailing rock, but at the 41st foot a change became apparent, and an increase of silver occurred, and the black or silver bearing slates begin to appear on the foot wall; at this point the vein measures 4 ft. 2½ ins. in width, with a pay streak of ore averaging 22 inches in width.

Surface improvements on this mine consist of stable, blacksmith shop, powder magazine, sleeping camp, shaft house, and one large substantial boarding and dwelling house combined. A large store house is also nearing completion. The buildings enumerated are ample for the requirements of the mine, and their value is estimated at \$2,500.

The Wolverine Mine is situate to the immediate east of the "Queen," on the north shore of Whitefish Lake. The location contains nearly 80 acres. The located line of the Port Arthur, Duluth & Western Railway, part of which has already been contracted for, passes through the property.

The Wolverine is well wooded with timber suitable for building and mining purposes, while its elevation above the lake affords facilities for economical mining seldom met with.

Manitoba and North-West Territories.

Mr. Thomas Mitchell, jr., of Toronto, is at Medicine Hat with the sole purpose of having a shaft sunk on the Medicine Hat Railway & Coal Company's lands a few miles west of that place.

Letters patent have been issued incorporating David Hyslop, of Killarney; G. Crowe, W. H. Hastings, Thomas H. Preston and Colin H. Campbell, barrister, the last four of Winnipeg, under the name of "The Manitoba Coal Company, Limited," for the purpose and with the object of mining and extracting coal in the Province of Manitoba. The district to be opened lies about 15 miles south-west of Deloraine.

It is reported that Lieutenant Cochrane has organized an English company with a capital of \$1,000,000 to develop the coal beds in the vicinity of Cochrane, N.W.T. Lieutenant Cochrane is expected home from England this month.

British Columbia.

The miners employed by Messrs. Dunsmuir & Sons, of the Wellington Colliery, now working at what is known as the Sabiston and Horne Mine, have opened into a seven-foot seam of excellent coal. This property is in the famous Millstream Valley on the Nanaimo side of the East Wellington property, and the work of opening it up will be prosecuted with the utmost vigour. Quite a number of men are now engaged at this work.

At a recent meeting of the shareholders of the Canadian Anthracite Coal Co. held at St. Paul, it was decided to continue the present contract for supplying the whole output—which amounts to 100 tons a day—to San Francisco merchants and to renew the contract with the miners for mining the coal and placing it on the cars. The difficulties between the company and the Canadian Pacific railway company have been satisfactorily adjusted and the working of the mines will probably continue unchecked. The whole output is to be deposited at San Francisco and no attempt will be made to supply eastern markets. Improved machinery has been erected at the mines and the coal is now turned out in regular sizes, screened and free from shale. Some new seams are being opened just east of the present workings, and another colliery will be started shortly.

Despatches from Field, under date of 13th, state that between thirty-five and forty men employed at the Monarch mine were discharged to-day, but as none of them appear to have received the slightest explanation it is not known why, or for how long, work will be suspended. It is reported that the company's smelter at Vancouver has proved incompetent to handle this ore, and that about two months will probably elapse before the necessary alterations can be made. The British Columbia Smelting Company therefore do not require any more ore at Vancouver just now, and it is not convenient to have any quantity accumulate here. It is to be hoped that active operations will be resumed at the Monarch immediately the smelter is in working order as the successful working of this mine would be of much benefit to the neighborhood, and its failure very discouraging.

The latest report, dated the 19th inst., states that the Mount Ceniz Tunnel, Perry Creek, is now driven in 616 feet. Ten experienced miners are working day and night shifts, and besides these other men are constantly employed

hauling timber and sawing out lumber. The result of last month's washing was 80 ounces gold of the same quality as the 60 ounces previously received, which, assayed at Selby's Smelting works in San Francisco, yielded \$18.50 per ounce. The pump and machinery intended for the company's shaft, distant six miles from the tunnel, is still lying at Cranbrook. With the beginning of spring (the present temperature at Cranbrook is 12 degrees below zero) it will be moved and work commenced on this portion of the company's ground.

It is reported that when the price of coal went up the wages of all miners on Puget Sound were advanced 15 per cent. on the stipulation that if the price of coal went down wages should be lowered as much as they had been advanced. During the past few months the price of Seattle coal has dropped from \$10 to \$6 in the San Francisco markets, the supply being so much greater than the demand. Owing to this drop in prices the coal companies now claim that at the present prices coal cannot be mined and marketed so as to leave a fair margin of profit. To meet this exigency meetings have been held by the mine operators, and a reduction of 15 per cent in the wages of miners has been determined upon. Just when the reduction will go into effect has not been definitely determined upon, but it will not be longer than a few days.

The *Colonist* says: Col. Baker has received intelligence from the mine on Perry Creek to the effect that \$1,440 had been taken out of the tunnel for the four weeks ending 17th February; \$400 of that sum in the last week. The canyon has narrowed down, and bedrock is flat, and the evidences are that the end of the canyon is about reached. When once rough bedrock is secured it is thought that large quantities of gold will be taken out. Every day may bring news of a big strike.

A Big Blast.—On 25th ult., five tons of powder were exploded in Schneider's granite quarry, at Graniteville, Mo., and the force upturned a mountain of granite fifty-two feet in the air. The shaft was sunk 100 feet in solid granite, and the chambers were thirty feet long, cut on each side of the shaft. The powder was packed in close. About one hundred people witnessed the great upheaval from a safe position. The concussion was terrific, and the windows in houses for some distance were broken. Blocks of granite weighing 100 tons were tossed in the air.

A Remarkable Well.—A remarkable well was completed on Tuesday at the Mabel furnace (S. Perkins & Co. proprietors), Sharpsville, Pa. It is a shaft 11 by 13 feet and 84 feet deep, and furnishes clear, pure, soft, cold water at the rate of from 25,000 to 30,000 gallons, or over 100 tons, an hour. The workmen passed through 15 feet of surface, and then through 40 feet of blue clay, when they struck sand and gravel, evidently the bed of an ancient river. Water was first found at a depth of 74 feet, but the shaft was pushed on down 10 feet further, when the rapid inflow forced a cessation of further operations. It was sunk under the efficient supervision of Mr. M. W. Jenkins, mining boss of the New Virginia Coal Co., and took about two months.—*Colliery Engineer*.

Canadian Mining Companies in England

	Price Per Share.
eral Mining, Limited £219,752 fully-paid shares of £8	4½ 5
w Point, Barrasois and Langan, \$309,100 fully-paid shares of \$100	—
Ditto, \$200,000 vendors fully-paid shares of \$100	—
North-Western Coal and Navigation, Limited, £160,500 6 per cent. debentures; coupons June 30 and Dec. 31; principal 1904	—
Ditto £142,500 fully-paid ordinary shares of £10	—
Ditto £900 fully-paid de'ferred shares of £100	—
dney and Louisburg Coal and Railway, Limited, £50,000 cumulative 10 per cent. first preference shares of £10, £6 paid	7 9
Ditto, £14,560 fully-paid non cumulative 6 per cent. second pref. of £10	3 5
Ditto, £250,000 fully-paid ordinary shares of £10	1 2
ancouver Coal Mining and Land, Limited, £66,850 fully-paid shares of £10	—
Ditto, £118,150 shares of £10, £9 paid	6½ 7½
Senior Copper, Limited, fully-paid shares of £1	—
Ditto, shares of £1, 17s. 6d. paid	—
anah Weachu, Limited, £99,888 fully-paid shares of £1	—
ver Wolverine, Ltd., £68,465 fully-paid shares of £1	—
glo-Canadian Asbestos, Limited, £39,132 fully-paid shares of £2	—
glo-Canadian Phosphate, Limited, £46,340 fully-paid pref. shares of £10	—
Ditto, £15,050 fully-paid deferred shares of £10	—
ish Columbia Smelting, Ltd., £25,000 preference shares of £1, 10s. pd.	—
Ditto £40,000 fully paid ordinary shares of £1	—
nadian Asbestos and Antimony Company, Limited, £160,000 fully called shares of £5	—
nadian Phosphate, Ltd., £100,000 fully paid shares of £1	¼ 1

General Mining.—Accounts to December 31 submitted in April, an interim meeting is held in November. Dividend for 1884, 5 cent; for 1885 and 1886, 3½ each year; and for 1887, £4 13s. per cent. Reserve fund, £29,850.

Low Point.—The vendors' shares, up to the end of 1888, do rank for dividend until 7 per cent. per annum dividends have been paid on ordinary. Accounts to Dec. 31. For 1887, 5 per cent. paid on the ordinary shares other than those held by the General Mining Assoc., that Company foregoing their dividend rights.

North-Western Coal.—The deferred shares receive on dividend 15 per cent. per annum (cumulative) has been paid on the ordinary. Accounts to June 30. Dividend for 1887-8, 5 per cent.

Sydney and Louisburg Coal.—Accounts to Dec. 31 submitted in May. Out of the profits of 1884 one half-year's dividend on the first preference shares was paid. No dividend since. Debit to Dec. 31, 1887, £1,574.

Vancouver Coal.—Accounts to June 30 and December 31 submitted in November and May. In the half-year to June, 1888, there was a net profit of nearly £11,000. Debentures, £57,200, reconstruction has been decided on.

Excelsior Copper.—Registered September 26, 1888. Authorized capital, £450,000; purchase consideration, £400,000, in cash or ares. Fully-paid shares issued to the vendor; partly paid to the bid.

Shuniah Weachu.—Accounts to Nov. 20 submitted in February. No dividend yet.

Silver Wolverine.—Registered October 19, 1888, with a capital £100,000, of which £80,000 was the first issue. Most of the ares were issued to the vendor.

Anglo-Canadian Asbestos.—The Company was registered in November, 1885. Accounts to October 31 submitted in March. No dividend yet. Debentures, £3,450. Reports are not obtainable, at this information is official.

Anglo-Canadian Phosphate.—The preference shares rank first 7 per cent., and after a like rate has been paid on the deferred ares, both classes rank equally.

British Columbia Smelting.—The company was registered May 9, 1888. The ordinary shares were issued to the vendor, and they do not rank for dividend until the preference shares have received dividends amounting to 100 per cent.

Canadian Asbestos and Antimony Company, Limited.—Registered March 2, 1889. Of the capital as above, £50,000 was issued the vendors as fully paid, and the remainder was allotted to the public, £3 being payable on application and allotment, £1 one month after, and the balance two months after.

Canadian Phosphate.—Accounts to November 30 submitted in February. Eleven months to Nov. 30, 1888, resulted in a profit of £2,576, which was carried forward.

Something About Coal Mining.

C. T. MAGRATH, D. L. S., LETHBRIDGE.

There seems to be a prevailing idea among a great many that the extraction of coal is a very lucrative business, one which require little capital for development, and yielding immense profits.

One of the sources occasioning this error is doubtless the fact that seams of lignite and coal are very often visible in the outcrops along the valleys of our rivers, and to those contemplating the working of any of these seams I presume the two principal factors entering into their profit and loss statements would be the contract price paid to miners and a trifle for transport to markets, leaving a very large margin up to the selling price, to the consumer. For the proper development of a mine, the first consideration of the operator is a thorough examination of the coal area to be worked out, and a Diamond Drill, though somewhat expensive, is probably best adapted for this work, owing to its withdrawing a "core" from the different measures passed through. The general dip of the seam may then be obtained and shafts and surface works so located as to give the best combined results for the future development of the mine—for instance, underground drainage, also underground haulage with respect to grades. Seams of coal may be found dipping from 0 to 90 and the nearer a horizontal position the easier worked, for several reasons; one I might give, is the adaptability of such a seam for the introduction of mining machinery, of which I will speak later on. Rarely, however, is a seam found to remain level for any distance, being more or less undulating. Dipping seams, especially when they approach a vertical position, are often very uncertain, as in this position the seam may be most "faultry." I have seen in the mountainous regions of Southern Montana, abandoned coal mines, where, in one case, probably five hundred thousand dollars were expended in developing a vertical seam, to find that the coal ultimately disappeared. The percentage extracted of the total amount in the seam, varies from 50% in some mines to 80% in others, and depends altogether upon the character of the roof. In many instances in a mine with a soft roof, unfinished chambers have to be abandoned on account of the roof coming down, leaving buried large tracts of coal which it would be too expensive to reclaim.

Props for the support of the roof are quite an item in cost of production, and as the mine becomes developed the percentage of timbering increases, owing to the "entries" or arteries through which the coal is hauled, daily becoming longer. In addition, these entries require constant attention in the renewal of timbers. Then again in the chambers, the props are rarely reclaimed unless in mines where the roofs are composed of good strong shales or sandstone.

The manner of mining the coal is governed to a certain extent by its physical conditions. If the roof is very good, the system of long-wall work may be adopted with advantage. In this system a long continuous face of the coal is exposed and by propping the roof along this face, sufficient room is secured for the workmen, behind whom the roof keeps giving away as the work advances. The necessary roads through the workings are usually supported by masonry.

The other method of mining the coal is by "pillar and room" or chamber workings, which to be applied in different seams, requires changes and modifications, depending upon the nature of the roof. Under this system we have what

are known as "Double Entries," which consists of two passages, each about 8 feet wide, and driven parallel with a pillar of coal between them varying in thickness from 15 to 20 feet. From these, chambers or rooms are laid off, leading to the right and left from the respective entries. These rooms are driven 9 feet wide a distance of about 15 feet, when they are widened out to various widths consistent with the quality of the roof. Usually, however, with a fair roof, rooms 27 feet in width may be driven the full depth required, before the superincumbent mass is likely to come down. The locating of the rooms along the side of an entry depends upon the maximum width of room after it turns the pillar, i. e. where the width is increased after driving the last 15 feet. Provision is made so as to leave a pillar of coal about 12 feet in width between each room, running its entire length from which the coal is extracted backwards to within 15 feet of the entry, after the room has been driven the required length. By this means solid pillars of coal of about 15 feet in length by various widths may be found along one side of the entry and separated by the 9 feet entrances to rooms either worked out or under process of extraction, while the opposite side, with the exception of cross-drifts for air or roadways, is one continuous pillar of coal, separating the two entries. These pillars are left for the purpose of supporting the roof, and though 15 feet is mentioned herein as the usual distance pillars extend back from the entries, yet this does not follow in all mines as the dimensions of pillars for the support of roofs depend entirely upon the depth of stratification overlying the coal. "Double Entries" are necessary for ventilation. If the workings are on an extensive scale, the ventilating current is by mechanical means forced through one entry up to near the "face" or end of that entry, supplying on its way the several rooms, then passing through a cross-drift, the other entry is converted into a return air-way. As the entries are driven forward, these cross-drifts are closed up and new ones cut near the face, so as to ventilate the more advanced portions of the workings. Should it be found necessary at any time to abandon any particular set of entries, the pillars then standing may be extracted backwards from the face.

Some coals are much harder to cut than others, and owing to certain seams having a distinct cleavage, with faces regular and parallel, the coal is much easier cut by working on or against the faces, making it therefore necessary to drive the entries on or against the "butts." This is especially the case with the lignites and bituminous coals of North-Western Canada. The maximum depth of the rooms or distance between sets of entries is variable in different mines and the management in defining this distance, is governed by the quality of the roof, and also by the greatest distance it is desirable to make miners shove their mine wagons out to the entry, from which point the wagons are afterwards hauled to the shaft or other outlet by means of either horses, mules or machinery. Rapid stides have of late years, been made in the improvement of machinery used in connection with collieries, such as hoisting engines, coal-cutting machines, drills, mine waggons, tipples, underground haulage by means of endless chains, etc., etc.

Respecting coal-cutting machines, several forms have been invented, of which the "Legg" is probably the best in use to day. These machines are operated by compressed air, which is conveyed into the mine through large wrought-iron pipes about 5 inches in diameter, and stored in reservoirs situated in different parts of the workings. From these reservoirs, permanent

An Extraordinary Story.—The *Colliery Guardian* is our authority for the following extraordinary story: "A most singular experience has just befallen a Rhondda collier, named David Davies, of Treherbert. He was one of the many sufferers by the memorable explosion at Penygraig Colliery in 1880, for four years after which he was confined to his bed. He then gradually got about, but always remained absolutely deaf and dumb from the shock. The doctor who attended him advised him to try a shock somewhat similar to that which had caused his infirmity. A little while ago he placed himself as near, as safety would allow, to where six shots were to be fired in the Bute Pit, Treherbert, and, strange to say, at the sixth shot his hearing returned to him. Still he was dumb, but on Sunday, the 3rd inst., the Rev. E. Rowlands, missionary to the deaf mutes, said something to Davies which put him in a passion, and he involuntarily, or instinctively, made an attempt to express his anger. To his amazement, the power of speech came back, and he now talks freely."

pipes carry the air forward, from which smaller and temporary ones, supplying the machines, lead to the various portions of the mine. The object of storing the air in reservoirs is manifold; the supply from them being more uniform than if direct from the compressor, as the deep pulsations of the piston would be felt by the machines. It is supposed that the exhaust from coal-cutting machines adds to the ventilation; however, in mines of any magnitude, the assistance is hardly appreciable. Coal cutting machines are undoubtedly of great value to coal operators, as the work they perform, viz.:—the under-cutting of the coal, is that which would otherwise require skilled labour, so that, wherever in use, the management is not altogether at the mercy of labour organizations. Apart from this, the machines—especially in mines where long-wall work may be carried on—materially reduce the cost of production, but if the roof of the mine is poor necessitating the driving of narrow rooms, then it is questionable if mining by picks is not as cheap, owing to the time lost in moving the machine from room to room.

In conclusion, it is hardly necessary to state that coal-mining is becoming quite an important factor in the development of trade in the North-West, mines already being in operation at different points along the Bow River, from Calgary westward, also at Edmonton, Medicine Hat, Lethbridge, and on the middle fork of Old Man's River. Of course, some of these have not yet been developed to any extent, still the Lethbridge colliery may compare favorably with any in the Dominion of Canada, possessing as it does, the latest improvement in all kinds of machinery requisite for the proper working of a mine. It will, therefore, shortly be necessary for our legislators to enact laws governing the mining of coals in the Territories so as to ensure safety against inexperienced and reckless miners.

Rich Galena Mine in B. C.—The Blue Bell mine, belonging to Dr. Hednryx upon the east side of Kootenay Lake, B. C., exhibits at a depth of one hundred feet from the surface, an unbroken body of galena, over 36 feet in width. This far exceeds the thickest vein in the celebrated Cour D'Alene mines.

How to Get the Best Results from Coal.—The best engineer in Christendom cannot produce the best results with his plant when he has to depend upon an unskilled fireman, or upon himself, acting as fireman. It is a common notion that anybody can shove coal into a furnace, and that this constitutes all that a fireman needs to do. A great many mill agents, treasurers, to say nothing of boards of directors, cherish this idea, without realizing how serious it is. We assert that no man ought to be placed in charge of a coal-pile who cannot tell approximately how much can be deduced from it; it represents a certain number of foot pounds work; and has, therefore, a definite evaporative value. To speak plain, the coal-pile means just so many dollars' worth of work. The duty of expending this money, this raw material, should be intrusted to a well-experienced and well-paid fireman. Every engineer has his own specific share of work, and only false economy demands that he should move out of it. Engineers are neither omniscient nor omnipresent, but if they know their business, and are not afraid to tell the truth, they will not hesitate to recognize and condemn the wastefulness of the policy of hiring either a cheap fireman or no fireman at all.—*Practical Electricity.*

A Visit to a Charcoal Iron Furnace.

(WRITTEN FOR THE REVIEW BY SAM'L D. MILLS,
SUPT. MARTEL FURNACE CO., ST. IGNACE,
MICH.)

The ore thus reduced is in the condition of a metallic sponge, saturated with carbon and mixed with earthy impurities. It passes down till it reaches the zone of fusion, as it is termed, where the heat is so great that both the iron and these impurities are melted and drop down into the "crucible" below the "tuyeres." Here the slag or cinder formed by the fusion of the earthy matter, being lighter than the iron, floats on top, and is tapped off through the cinder notch, which is so placed as to enable it to be drawn off without letting the iron run too. As for the iron you will see presently what is done with it.

We now hurried round to the end of the "Casting-house," and had just time to notice how the sand is moulded up to form the "pigs." A sort of ditch leads straight from the front of the furnace down the middle of the house, having on one side several branches communicating with the "pig" moulds. These are arranged in beds containing about 25 in a bed. The branches are called "sows;" the main line the "runner." Across the "runner" are set wide iron staples, and resting against these and stuck down into the "runner" are the "gates"—cast-iron blades with long handles, in shape very much like the ace of spades—coated with clay, and large enough to dam up the runner. Up near the furnace is a large "gate," slightly different in shape, and with a long bent handle resting on a hooked iron staff fastened at the side of the "runner." This is called the "skimmer." While we were examining this portion of the furnace the whistle blew, and the keeper in charge started to work. He took a pointed bar and in a couple of minutes cut a hole into the iron notch, and the molten iron came leaping out. It was down the "runner" until it struck the first "gate," which forced its course into the first bed; and when this was partly full the "gate" was pulled out a little in order to let some of the iron down to the second bed, into which it was forced by the second "gate." By the time this was partly filled the first bed had been completely filled, and the "gate" was then "stuck" across the "sow" in order to prevent any more iron getting in. This operation was repeated until nearly eleven beds were full, making, we were informed, about twenty tons of iron. Just as they were filling the 6th bed one of the men called out "cinder?" and dropped the "skimmer" across the "runner." We saw a large stream of molten "cinder" flow over the side of the runner into a shallow channel, which led out into the yard close by the Casting-house. Three shrill blasts from the whistle sent the engine full speed; flames leaped from the iron notch, in turn succeeded by a brilliant shower of sparks which drove everyone out of the building. In a few minutes the men who had gone outside to get cool came in. Some pulled out the gates and staples; another threw sand on the red hot iron; two others, with wooden clogs strapped to their feet, walked over the red hot iron, and with long bars pried the "pigs" loose from the "sows," at the same time breaking the "sows" into pieces about 30 inches long. A workman who had been washing the hot "gates" with clay water came to the assistance of the others, and

in less than ten minutes the whole cast was broken up. We are told that in a couple of hours the "grader" and his men would come and break each "pig" in two, grade it all according to the grain, or chill, if it be a chilling iron, mark each piece, and pile it all according to the various grades in different parts of the yard.

We then asked the following questions: Why was it necessary to crush the ore if the absorption of the carbon broke it up? This was done because the process of carbonization, being gradual, the larger lumps are reduced and carbonized last, and if too large would pass down into the zone of fusion unreduced in part, this would cause loss, owing to the unreduced oxide combining with the silica and running off in the cinder as a silica of iron, causing irregular working in the furnace, making hard iron, and injuring the product in many ways.

Why was it necessary to level the ore in the buggies and have it placed so evenly around the bell of the furnace? Because as the ore is distributed in the "hopper" so will it descend through the body of the furnaces. If too much ore was charged on one side of the "hopper," that side of the furnace would work colder than the other; the gases would pass up chiefly on the other side, through the lighter "burden," raw stock, or unreduced ore, would ultimately pass down to the tuyeres on the colder side; a tuyere might get closed up; and things would go from bad to worse unless the evil was attended to in time.

What is "chilling iron"? "Chilling iron is an iron in which a sort of crystallization can be produced by the sudden cooling of the molten metal. This has the effect of rendering it extremely hard and capable of standing a great amount of wear, or friction, a quality of great value in many ways, but particularly in the manufacture of car wheels. To utilize this property, the wheel is cast in a mould, the circumference of which is formed by an iron ring, some two inches thick, and of the full width, and same shape as the intended wheel, by contact with this the metal is chilled. By using a proper mixture of iron, the wheel when cast has an extremely hard surface on the tread, this hardness extending into the wheel about $\frac{3}{4}$ ", while the rest of the wheel remains soft and to some extent tenacious. Although it is customary to think cast iron brittle, it possesses considerable tenacity in comparison with chilled iron, which will sometimes break like glass. If the car wheel was chilled right through it would possess great hardness, but no strength, and it would be impossible, owing to its hardness, to bore out the hub of the wheel so as to fit it on the axle." A specimen of a chill was brought, and we were shown the peculiarity of its formation. It was what is called a good "needle chill," of a silvery white colour, and had a striated appearance as if composed of flattened needle points laid parallel, with the points extending, some a little further than others, into the grey, rather close-grained iron composing the rest of the piece (pig); the chill was very even all across the side of the pig, and was about $\frac{1}{2}$ " deep. "Here," said the manager, picking up a piece of pig, "is a specimen of iron chilled all through," then dashing it down upon another piece he broke it into three pieces and remarked: "This is what a car wheel would be like if chilled through. This iron was made at a time when we had some trouble with the furnace, in consequence of one of our water blocks cracking and letting a lot of water in. It chilled the furnace so that we got on to hard iron, and it was several days before we got work into good shape again."

An Ingenious Signalling Arrangement.

Our attention has lately been drawn to a most efficient arrangement for signalling by electric signal apparatus from cages in motion in colliery shafts, hoists, &c., which have been devised and carried out by Mr. William Armstrong, Jun., mining engineer, Wingate Grange colliery, Durham. The object is effected by inserting an insulated copper wire in the strand of the winding rope, and by connecting it at the cage end to a push in the cage by simple arrangements such as are ordinarily used in making such connections. At the drum end of the rope the insulated wire is brought out and connected to a brass ring working upon the drum-shaft, and upon which a strip of cotton rubs so as to maintain an electric connection with the signal bell and battery placed in front of the engine man working the winding engine. Those in the cage by touching the push can instantly communicate with the engine man at any part of the lift, and signal to him to stop or raise or lower the cage. At the Newbattle Collieries, Dalkeith, where the signalling apparatus is now working, it has been applied in the pumping shaft, 300 yards deep and is specially used by the pumpmen for working at the pumps in different parts of the shaft. By means of the signal, standing in, or upon the top of the cage, the men can instantly signal their requirements.

Connections are also put upon the frame of each deck of the cage, so that coal work signals can be made by means of the rope at a great saving of time.

The application appears to be of special value in case of repairs in the shafts, affording as it does absolute safety to the occupants of the cage in making the signals, and it would also be of inestimable value in cases of accident arising from explosion or break up in the winding shaft, where the state of the shaft or of the atmosphere is unknown, and where in such cases many lives have been lost through the occupants of the cage having no means of signalling to the engine man. A case such as this was the well-known and recent case at the De Beers mine in South Africa, where the cage and its occupants including Mr. Lindsay, the manager, was lowered into a deadly atmosphere without means of preventing the descent after the cage left the surface.

The whole arrangement appears to be most simple and effective, and must be a considerable economy, especially in making repairs where time is usually very important. The signal is working at several important collieries in England and bids fair to come into very general use.

A Grant from Quebec.—Mr. L. T. Rochon, M. P. P., states that it is almost certain that the Local Legislature will give \$1,000 to the fund for the visit of the American Institute of Mining Engineers.

The Production of Canadian Asbestos.

The following is the estimated production of asbestos in our Canadian mines since 1879:

Years.	Tons of 2,000 lbs.	Value in Dollars.
1879.....	300.....	19,500
1880.....	380.....	24,700
1881.....	540.....	35,100
1882.....	810.....	52,650
1883.....	955.....	68,750
1884.....	1,141.....	75,097
1885.....	2,440 $\frac{1}{4}$	142,441
1886.....	3,458 $\frac{1}{4}$	206,251
1887.....	4,619.....	226,976
	14,643 $\frac{1}{2}$	851,465

The figures of the output for last year (1888) are not all to hand yet, but the production will be fully equal to 4,500 tons, if not above it.

The Koepe System of Winding from Shafts.*

The Koepe system of winding from shafts is the invention of Mr. Frederick Koepe, Manager of the Hanover coal mine, Westphalia, one of the collieries worked by Krupp, the well-known German ironmaster. The first trial of the system was made at the Hanover shaft, and proved so successful that several engines belonging to the same owner were reconstructed on the new plan. From an examination by inspectors it was demonstrated to the satisfaction of the German government that the system was not only in every respect more economical than the ordinary method of hoisting, but had also elements of a greater safety to recommend its universal adoption. The plan has since been adopted at several mines in the same district and others in France, and still later at the Bestwood colliery, near Nottingham, England. The principal and simplest form of the Koepe system can be applied to existing hoisting machines at little cost, by attaching and suspending an old hoisting-rope from the under side of the cage at the top of the shaft and connecting the opposite end to the under side of the cage at the bottom of the shaft. This balance-rope may hang loosely in the shaft, or it may pass around a tightning-sheave at the bottom. In this way all the parts of the hoisting-apparatus are perfectly balanced throughout the lift, which is not the case by any other system of adjustment. There are several modifications of the system; but the principle is the same in all cases.

The advantages claimed for the Koepe system are as follows:

1. Balancing the hoisting-ropes, thus reducing the size of engine, consumption of fuel and cost of plant for a given duty
2. The same engines will raise a given load from any depth in the shaft.
3. One rope only is necessary instead of two.
4. Safety from overwinding.
5. Less wear and tear of plant.

The benefit will be more readily appreciated by taking examples of engines fitted with parallel drum, in comparison with the Koepe engines with winding-pulley and counterbalancing tail-rope. This, according to the greater or less depth of shaft, varies from 35 to 64 per cent. of the power required to lift the unbalanced load. Wherever parallel drums are used it is possible to increase the duty of the engine by the addition of a balance-rope.

Quite recently a plan has been adopted at a Pennsylvania colliery, said to be a new invention, and called the "Poore" system, which is believed to be nothing more than a modification of Mr. Frederick Koepe's invention.

It is not necessary to enter into further particulars. The system will be found fully described and illustrated in the *Transactions of the Chesterfield and Derbyshire Institute of Mining, Civil and Mechanical Engineers*, vols. xi. and xii., 1882-83, from which I have gathered my information.

*Trans. Am. Inst. of Mining Engineers.

WANTED.

A FIRST CLASS

Phosphate Property

If not absolutely first class will not be looked at. Particulars to

ROBERT H. JONES,

CANADIAN MINING AGENCY,
82 Queen Street, Cheapside, London, England.

Diamonds, Jewelry, Watches & Silverware

AT ROSENTHAL'S

Goldsmith's Hall, 87 Sparks St.

OTTAWA.

WORKS

—BY—

Professor E. J. CHAPMAN

Published by the COPP, CLARK CO. (LIMITED), TORONTO.

I.

MINERALS AND GEOLOGY OF CENTRAL CANADA,
COMPRISING THE PROVINCES OF ONTARIO AND QUEBEC.

Third Edition.

With 250 wood-cuts and a copious Index.

II.

AN OUTLINE OF THE GEOLOGY OF CANADA,
INCLUDING ALL THE PROVINCES OF THE DOMINION.

With six sketch-maps and six plates of characteristic fossils.

III.

BLOWPIPE PRACTICE.

WITH ORIGINAL TABLES FOR THE DETERMINATION OF
ALL KNOWN MINERALS.

This work has been favourably noticed in the 11th and 12th editions of Von Kobell's celebrated *Tafeln zur Bestimmung der Mineralien*.

IV.

PRACTICAL INSTRUCTIONS

FOR THE DETERMINATION BY FURNACE ASSAY OF GOLD AND
SILVER IN ROCKS AND ORES.

Second Edition.

V.

THE MINERAL INDICATOR:

A PRACTICAL GUIDE TO THE DETERMINATION OF GENERALLY-
OCCURRING MINERALS.

In preparation—A SYNOPSIS OF MINING GEOLOGY.



KINGSTON DRY DOCK.

Notice to Contractors.

SEALED TENDERS addressed to the undersigned, and endorsed "Tender for Dry Dock," will be received at this office until Thursday, the 24th day of March next inclusively, for the construction of a Dry Dock at Kingston, Ontario, in accordance with plans and specification to be seen on and after Wednesday, the 6th day of March next, at the Engineer's Office, 30 Union Street, Kingston, and at the Department of Public Works, Ottawa.

Intending contractors are requested to bear in mind that tenders will not be considered unless made on the printed forms supplied and accompanied by a letter stating that the person or persons tendering have carefully examined the locality, have satisfied themselves as to the nature of the materials to be excavated, and the foundations for the cofferdam and its probable cost. Tenders must be signed with the actual signatures of the tenderers.

An accepted bank cheque, not limited as to time of payment, for the sum of \$20,000, payable to the order of the Minister of Public Works, must accompany each tender. This cheque will be forfeited if the party decline to enter into a contract when called on to do so, or fail to complete the work contracted for, and will be returned in case of non-acceptance of tender.

The Department does not bind itself to accept the lowest or any tender.

By order,

A. GOBEIL,
Secretary.

Department of Public Works
Ottawa, 15th February, 1889.

88, 90, 92, 94 Rideau, 15 to 23 Mosgrove
and 186 Sparks Sts.

S. & H. BORBRIDGE,

Manufacturers of

Saddles, Harness, Trunks, Valises, Bags,
Satchels, Horse-Blankets, Beef and Oil-
Tanned Moccasins.

OTTAWA.



Mining Regulations

TO GOVERN THE DISPOSAL OF

Mineral Lands other than Coal Lands, 1886.

THESE REGULATIONS shall be applicable to all Dominion Lands containing gold, silver, cinnabar, lead, tin, copper, petroleum, iron or other mineral deposits of economic value, with the exception of coal.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein either by surface or subterranean prospecting for mineral deposits, with a view to obtaining under the Regulations a mining location for the same but no mining location or mining claim shall be granted until the discovery of the vein, lode or deposit of mineral or metal within the limits of the location or claim.

QUARTZ MINING.

A location for mining, except for iron on veins, lodes or ledges of quartz or other rock in place shall not exceed forty acres in area. Its length shall not be more than three times its breadth and its surface boundary shall be four straight lines, the opposite sides of which shall be parallel, except where prior locations would prevent, in which case it may be of such a shape as may be approved of by the Superintendent of Mining.

Any person having discovered a mineral deposit may obtain a mining location therefor, in the manner set forth in the Regulations which provides for the character of the survey and the marks necessary to designate the location on the ground.

When the location has been marked conformably to the requirements of the Regulations, the claimant shall within sixty days thereafter, file with the local agent in the Dominion Land Office for the district in which the location is situated, a declaration or oath setting forth the circumstances of his discovery, and describing, as nearly as may be, the locality and dimensions of the claim marked out by him as aforesaid; and shall, along with such declaration, pay to the said agent an entry fee of FIVE DOLLARS. The agent's receipt for such fee will be the claimant's authority to enter into possession of the location applied for.

At any time before the expiration of FIVE years from the date of his obtaining the agent's receipt it shall be open to the claimant to purchase the location on filing with the local agent proof that he has expended not less than FIVE HUNDRED DOLLARS in actual mining operations on the same; but the claimant is required, before the expiration of each of the five years, to prove that he has performed not less than ONE HUNDRED DOLLARS' worth of labor during the year in the actual development of his claim, and at the same time obtain a renewal of his mining receipt, for which he is required to pay a fee of FIVE DOLLARS.

The price to be paid for a mining location shall be at the rate of FIVE DOLLARS PER ACRE, cash, and the sum of FIFTY DOLLARS extra for the survey of the same.

No more than one mining location shall be granted to any individual claimant upon the same lode or vein.

IRON.

The Minister of the Interior may grant a location for the mining of iron, not exceeding 160 acres in area which shall be bounded by north and south and east and west lines astronomically, and its breadth shall equal its length. Provided that should any person making an application purporting to be for the purpose of

mining iron thus obtain, whether in good faith or fraudulently, possession of a valuable mineral deposit other than iron his right in such deposit shall be restricted to the area prescribed by the Regulations for other minerals, and the rest of the location shall revert to the Crown for such disposition as the Minister may direct.

The regulations also provide for the manner in which land may be acquired for milling purposes, reduction works or other works incidental to mining operations.

Locations taken up prior to this date may, until the 1st of August, 1886, be re-marked and re-entered in conformity with the Regulations without payment of new fees in cases where no existing interests would thereby be prejudicially affected.

PLACER MINING.

The Regulations laid down in respect to quartz mining shall be applicable to placer mining as far as they relate to entries, entry fees, assignments, marking of localities, agents' receipts, and generally where they can be applied.

The nature and size of placer mining claims are provided for in the Regulations, including bar, dry, bench creek or hill diggings, and the RIGHTS AND DUTIES OF MINERS are fully set forth.

The Regulations apply also to

BED-ROCK FLUMES, DRAINAGE OF MINES AND DITCHES.

The GENERAL PROVISIONS of the Regulations include the interpretation of expressions used therein; how disputes shall be heard and adjudicated upon; under what circumstances miners shall be entitled to absent themselves from their locations or diggings, etc., etc.

THE SCHEDULE OF MINING REGULATIONS

Contains the forms to be observed in the drawing up of all documents such as:— "Application and affidavit of discoverer of quartz mine." "Receipt for fee paid by applicant for mining location." "Receipt for fee on extension of time for purchase of a mining location." "Patent of a mining location." "Certificate of the assignment of a mining location." "Application for grant for placer mining and affidavit of applicant." "Grant for placer mining." "Certificate of the assignment of a placer mining claim." "Grant to a bed rock flume company." "Grant for drainage." "Grant of right to divert water and construct ditches."

Since the publication, in 1884, of the Mining Regulations to govern the disposal of Dominion Mineral Lands the same have been carefully and thoroughly revised with a view to ensure ample protection to the public interests, and at the same time to encourage the prospector and miner in order that the mineral resources may be made valuable by development.

COPIES OF THE REGULATIONS MAY BE OBTAINED UPON APPLICATION TO THE DEPARTMENT OF THE INTERIOR

A. M. BURGESS,

Deputy Minister of the Interior.

TORONTO BAG WORKS

MANUFACTURERS OF

BAGS for ORES, PHOSPHATES, ETC.,

AND FOR ALL OTHER PURPOSES.

DICK, RIDOUT & CO.,

11 and 13 Front St. East,

TORONTO.

SHIPMAN ENGINES, ACME MODEL. COAL OIL FOR FUEL.



To parties requiring a safe, reliable, durable and economical Steam Launch, from 20x4 to 35x7 with ample power to give satisfactory speed, we can supply the best on the market and at prices which will defy competition for a like quality of goods. We have a full staff of competent boat and engine builders and guarantee every article to be strictly first class. Hundreds of our engines from 1 to 12 h. p. Marine or Stationary have been in use for years and are acknowledged superior to all others. No smoke, dirt or sparks, no manual or mechanical labor necessary. You have the privacy of your launch for your family. As the water and oil supply is automatic very little attention is required. But a few minutes is necessary to get up 100 lbs. of steam; when you return to the boat house by turning a hand wheel all fire is extinguished. Orders for coming season should be placed at once, as the demand is much in excess of previous years. Write for 1889 circulars giving prices, testimonials, etc. No attention paid to postal cards.

JAMES GILLIES & CO., Carleton Place, Ont.

By Royal



Letters Patent.

The Perfection Smoke Consumer & Fuel Economizer.

FOR ALL HORIZONTAL BOILERS, STATIONARY AND MARINE.

At City Waterworks (Wheelhouse), C.P.R. Works and Canadian Rubber Co., Montreal

Users of Lancashire, Cornish, and other flued boilers, invited to correspond.

Improved method of setting for new and existing boilers.

Dobson & Brodie, - - 169 St. James St.,

MONTREAL.



**JOHN A. ROEBLING'S SONS CO.
WIRE ROPE**

—FOR—

Mines, Elevators, Inclines, &c.

**GALVANIZED GUY ROPE. BRIDGE CABLES.
HAWSER ROPES.**

WIRE of all kinds. Insulated WIRES

John A. Roebling's Sons Co.

117 & 119 LIBERTY St., NEW YORK.

H. L SHIPPY Sec'y.

VALUABLE PLUMBAGO

AND OTHER

Mineral Lands FOR SALE,

IN THE TOWNSHIP OF BUCK-
INGHAM, COUNTY OF
OTTAWA.

1st.—Lot 28, in the 6th range, containing 100 acres, in addition to the salina of the lake.

2nd.—North half of lot 23, in the 5th range, containing 100 acres.

3rd.—Nine acres of lot No. 23, in the 5th range, with water privileges thereto appertaining, being site of mill dam, etc., etc.

The property formerly belonged to the Montreal Plumbago Mining Company, and was worked successfully for several years, until the company's mill was destroyed by fire, but the mill dam remains almost uninjured, and there are on the property several houses, sheds, etc., built for various purposes when mining operations were carried out.

The Plumbago Deposits

upon the property are regarded as amongst the richest and most extensive in the Dominion. As to the quality of the Plumbago, it has been extensively used in the manufacture of crucibles, lubricating leads, stove polish, etc., etc., and given unbounded satisfaction. This is established by the experience of consumers, and by a certificate from the celebrated Battersea Crucible Works, London, England, a copy of which is open for inspection.

MICA

has also been discovered in quantity

The lands are in the Phosphate region, and recent prospecting has disclosed a rich and extensive deposit of this mineral. There are unrivalled facilities for transporting the ore to and from the mines by the Ottawa River and C. P. Railway. Distance from mines to Railway Station 6 miles. Good road.

All that is required to make these valuable mines handsomely remunerative is a little capital and enterprise.

The Title is Indisputable.

For information apply to

WM. H. DICKSON,
160 Waller St., Ottawa.

H. E. DICKSON,
Russell House, Ottawa.

OR TO THE OFFICE OF

THE CANADIAN MINING REVIEW
OTTAWA.

F. G. BECKETT ENGINE CO.

HAMILTON, ONT.



Having had many years practical experience in the manufacture of

MINING MACHINERY

IS NOW PREPARED TO CONTRACT FOR

Stamp Mill Machinery,
Concentration Mills,
Revolving, Roasting and
Drying Furnaces.
Rock Breakers,
Cornish Rolls for crushing,
Amalgamating Pans and Settlers,
Concentrators and
Revolving Screens,
Smelting Furnaces, Retorts,

HOISTING ENGINES,

EITHER GEARED OR DIRECT ACTION.

Cornish Pumping Machinery,
Iron Ore Cars, Safety Cages, &c.,
Rock Drills and Air Compressors.

STEAM ENGINES AND BOILERS.

Marine Engines and Steam Yachts.



DEPARTMENT

OF

Inland Revenue.

An Act Respecting Agricultural Fertilizers.

before offering the same fertilizer for sale, transmit to the Minister of Inland Revenue, carriage paid, a sealed glass jar, containing at least two pounds of the fertilizer manufactured or imported by him, with the certificate of analysis of the same, together with an affidavit setting forth that each jar contains a fair average sample of the fertilizer manufactured or imported by him; and such sample shall be preserved by the Minister of Inland Revenue for the purpose of comparison with any sample of fertilizer which is obtained in the course of the twelve months then next ensuing from such manufacturer or importer, or collected under the provisions of the Adulteration Act, or is transmitted to the chief analyst for analysis.

If the fertilizer is put up in packages, every such package intended for sale or distribution within Canada shall have the manufacturer's certificate of analysis placed upon or securely attached to each package by the manufacturer; if the fertilizer is in bags, it shall be distinctly stamped or printed upon each bag; if it is in barrels, it shall be either branded, stamped or printed upon the head of each barrel or distinctly printed upon good paper and securely pasted upon the head of each barrel, or upon a tag securely attached to the head of each barrel; if it is in bulk, the manufacturer's certificate shall be produced and a copy given to each purchaser.

No fertilizer shall be sold or offered or exposed for sale unless a certificate of analysis and sample of the same shall have been transmitted to the Minister of Inland Revenue and the provisions of the foregoing sub-section have been complied with.

Every person who sells or offers or exposes for sale any fertilizer, in respect of which the provisions of this Act have not been complied with—or who permits

a certificate of analysis to be attached to any package, bag or barrel of such fertilizer, or to be produced to the inspectors to accompany the bill of inspection of such inspector, stating that the fertilizer contains a larger percentage of the constituents mentioned in sub-section No. 11 of the Act than is contained therein—or who sells, offers or exposes for sale any fertilizer purporting to have been inspected, and which does not contain the percentage of constituents mentioned in the next preceding section—or who sells or offers or exposes for sale any fertilizer which does not contain the percentage of constituents mentioned in the manufacturer's certificate accompanying the same, shall be liable in each case to a penalty not exceeding fifty dollars for the first offence, and for each subsequent offence to a penalty not exceeding one hundred dollars. Provided always that deficiency of one per centum of the ammonia, or its equivalent of nitrogen, or of the phosphoric acid, claimed to be contained shall not be considered as evidence of fraudulent intent.

The Act passed in the forty-seventh year of Her Majesty's reign, chaptered thirty-seven and entitled, "An Act to prevent fraud in the manufacture and sale of agricultural fertilizers," is by this Act repealed, except in regard to any offence committed against it or any prosecution or other act commenced and not concluded or completed, and any payment of money due in respect of any provision thereof.

A copy of the Act may be obtained upon application to the Department of Inland Revenue, as well as a copy of a Bulletin which it is proposed to issue in April, 1888, concerning the fertilizers

E. MIALI,
Commissioner.

January, 1889.



THE
Intercolonial Railway
OF CANADA.

The Royal Mail Passenger & Freight
Route between Canada and
Great Britain,

—AND—

Direct route between the West and all points on the Lower St. Lawrence and Baie des Chaleux; also New Brunswick, Nova Scotia, Prince Edward Island, Cape Breton and Newfoundland.

New and Elegant Buffet Sleeping and Day Cars run on through Express Trains.

Passengers for Great Britain or the Continent by leaving Toronto by 8 o'clock A.M. train Thursday will join Outward Mail Steamer at Halifax Saturday.

Superior Elevator, Warehouse and Dock accommodation at Halifax for shipment of grain and general merchandise.

Years of experience have proved the Intercolonial, in connection with steamship lines to and from London, Liverpool and Glasgow to Halifax, to be the quickest freight route between Canada and Great Britain.

Information as to Passenger and Freight rates can be had on application to

E. KING,
27 Sparks Street,
OTTAWA.

G. W. ROBINSON,
Eastern Passenger Freight Agent,
137½ St. James St., MONTREAL.

D. POTTINGER,
Chief Superintendent.

Railway Offices, Moncton, N.B.
Nov. 20th, 1888.

The Polson Iron Works Co'y
TORONTO, ONT.

Manufacturers of the Celebrated "Brown Automatic Engine."

GENERAL DEALERS IN

MINING MACHINERY.

SPECIAL AGENTS FOR

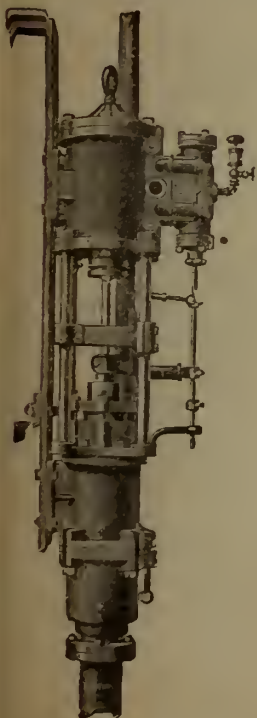
Knowles' Steam Pumps,

B. T. Sturtevant's Blowers and Fans,

Burleigh Rock Drills.

Hoisting Engines and Boilers, Quartz Mills, Diamond Prospecting Drills, Rock Breakers.

Office and Works, Esplanade E.; Warehouse, 38 Yonge St., - - - TORONTO.

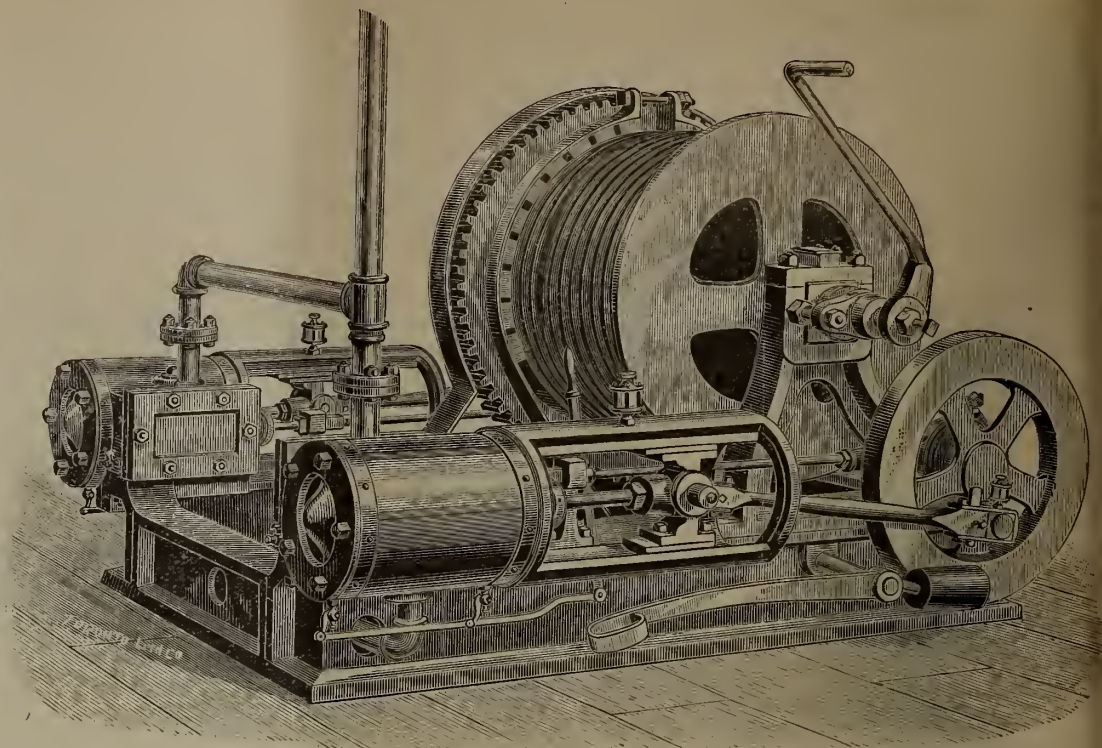


JOHN DOTY ENGINE CO.

Toronto, Ont.

MANUFACTURERS OF

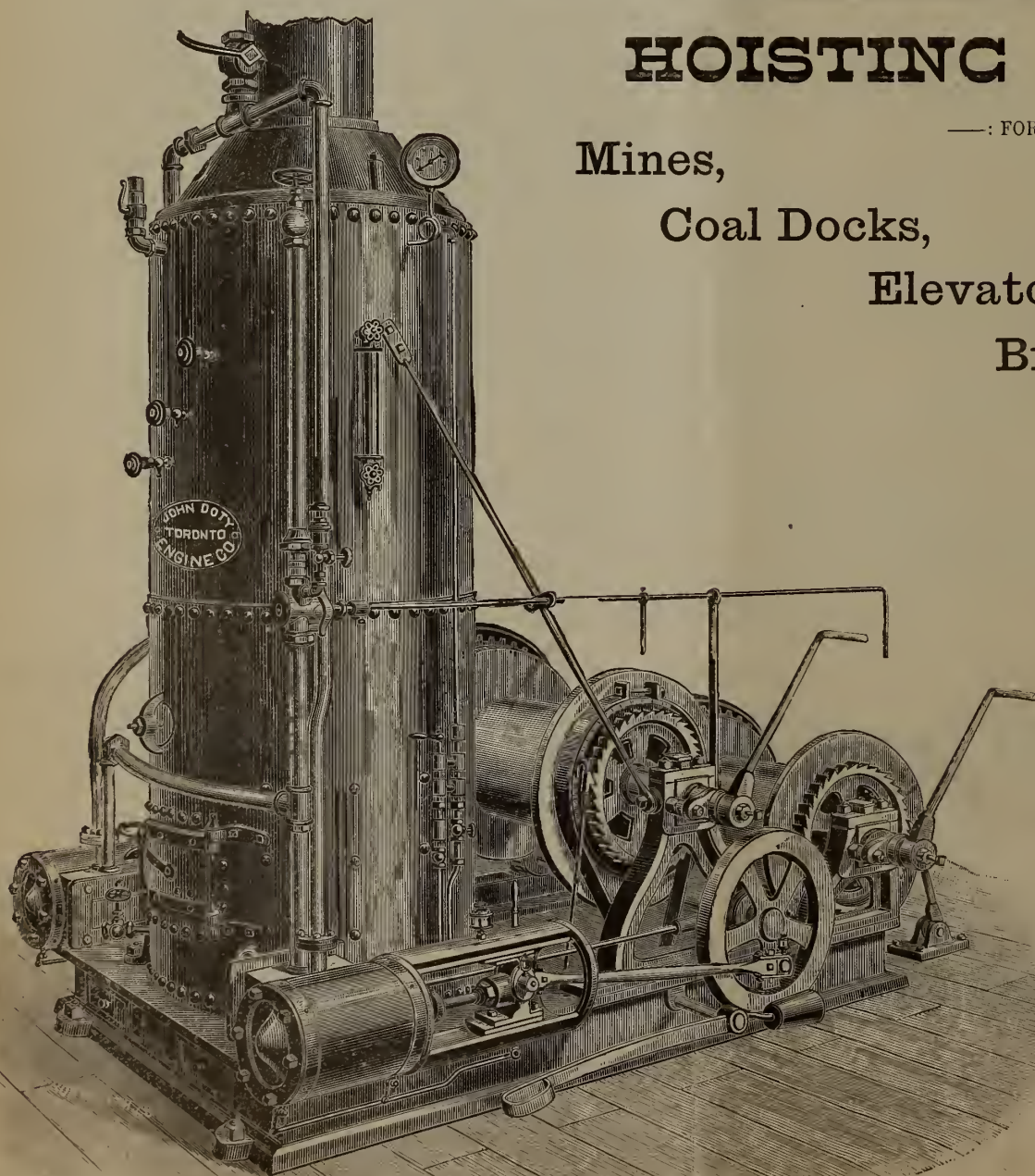
Mining & General
Machinery.



HOISTING ENGINES

—: FOR :—

Mines,
Coal Docks,
Elevators,
Bridge Builders,
Contractors, &c.



CORLISS ENGINES

Tug & Steam Yacht Engines,
Mill Engines.

Shafting & Mill
Gearing.

All Descriptions of Boiler
and Tank Work.

Send for Estimates and
Catalogues.

RUSSELL & CO.

PROVINCIAL AND DOMINION
LAND SURVEYORS,
CIVIL AND MINING ENGINEERS,
PORT ARTHUR, ONTARIO.

Mining Properties Surveyed, Reported on and Dealt in

Latest and Most Complete Plans of Thunder Bay
Mining District Always on Hand.

A. L. RUSSELL, A. H. MACDOUGLL, W. W. RUSSELL
P. L. S., D. L. S. P. L. S., D. L. S. M.E.A.MCAN.SOC.C.E

FOR SALE.

Asbestos Mines.

On Lots 27, 28 and 29, in Range A, of Colborne,
Megantic County, P. Q.

300 ACRES,

One Mile from Quebec Central Railway.

Free from Reserves or Royalties.

James Reed,

Reedsdale, Megantic, P. Q.



MONEY ORDERS.

MONEY ORDERS may be obtained at any
Money Order Office in Canada, payable in
the Dominion; also in the United States, the United
Kingdom, France, Germany, Italy, Belgium,
Switzerland, Sweden, Norway, Denmark, the
Netherlands, India, the Australian Colonies, and
other countries and British Colonies generally.

On Money Orders payable within Canada the
commission is as follows:

If not exceeding \$4	2c.
Over \$4, not exceeding \$10	5c.
" 10, " "	10c.
" 20, " "	20c.
" 40, " "	30c.
" 60, " "	40c.
" 80, " "	50c.

On Money Orders payable abroad the commis-
sion is:

If not exceeding \$10	10c.
Over \$10, not exceeding \$20	20c.
" 20, " "	30c.
" 30, " "	40c.
" 40, " "	50c.

For further information see OFFICIAL POSTAL
GUIDE.

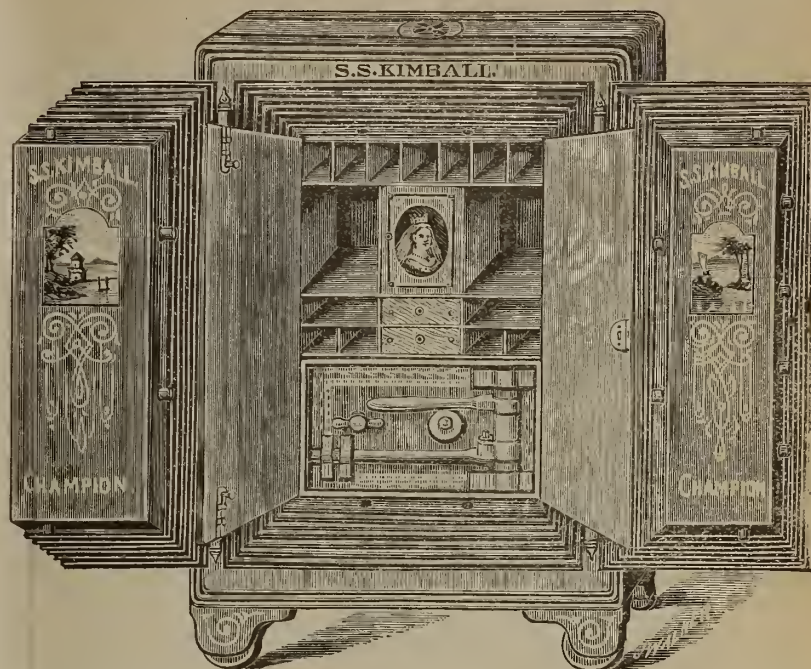
Post Office Department, Ottawa.
15th Sept., 1888.

Champion Fire and Burglarproof Safes.

These Safes have the best record of any in the Dominion. Price 30
per cent. cheaper than any other first-class Safe.

SEND FOR CATALOGUE AND PRICE-LIST.

C. S. KIMBALL,
577 Craig St., Montreal.



Van Duzen Steam Jet Pump.

MINING.—Our \$16 Pump preferred to a \$200 Steam Pump.



STATE OF MAINE ASSAY OFFICE,
F. L. BARTLETT,
PORTLAND, ME., June 21, 1883.

"GENTLEMEN,—The No. 5 'L' (\$16) Steam Jet Pump I purchased of you I have
used for raising water from a mining shaft fifty feet deep. I set it to draught twelve and force
thirty eight feet. It worked very well indeed, although I was obliged to carry steam 150 feet
from the boilers and in weather often below zero. I carried 75 pounds of steam at the boiler,
and the Jet Pump took the place of a No. 3 K (\$200 Piston Pump), that I had to remove.

"Yours truly, F. L. BARTLETT."

Address for further particulars,

CARTH & CO.,

MONTREAL

USE GURNEY'S

IMPROVED CELEBRATED

Hot Water Heaters!

Guaranteed more Economical than any other
Heater now made, and containing every
known Improvement in Hot
Water Heating.

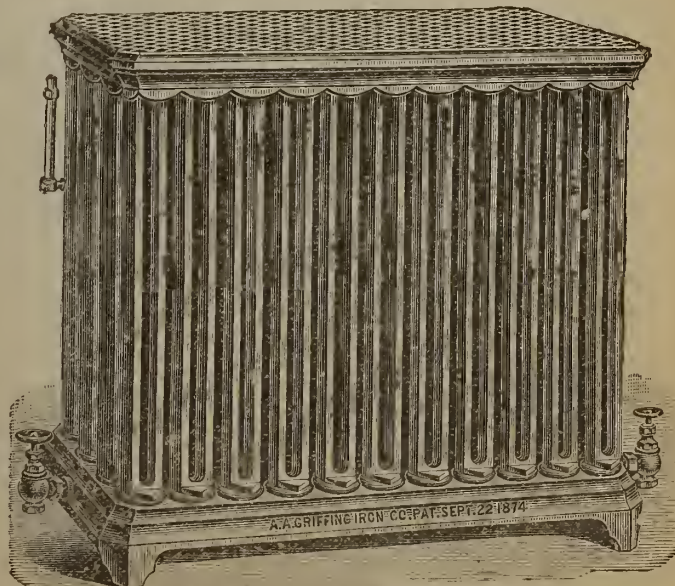
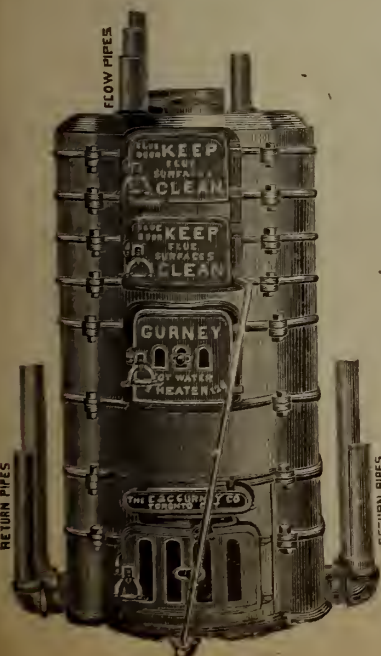
STEAM FITTINGS, CAST IRON PIPE,
REGISTER, GRATES, ETC.

HOT AIR FURNACES

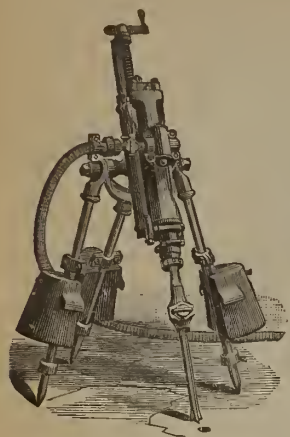
FOR COAL OR WOOD.

E. & C. GURNEY & CO.,

MONTREAL.

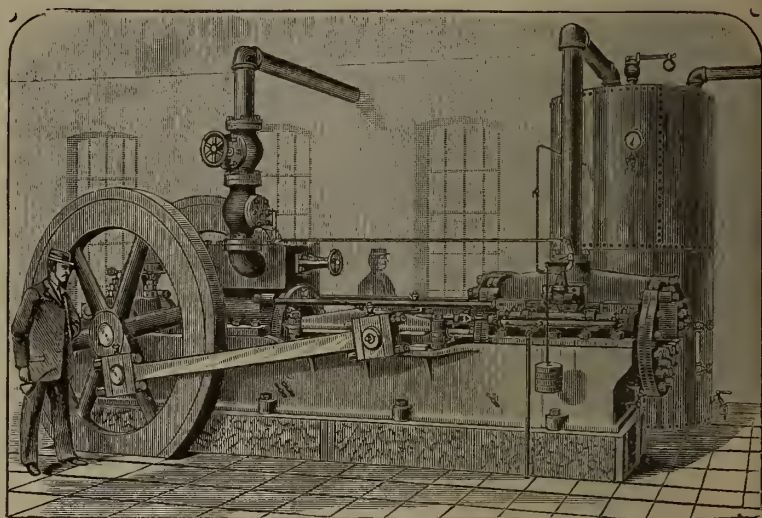


Bundy Radiators for Quick Circulation and Economy of Space.



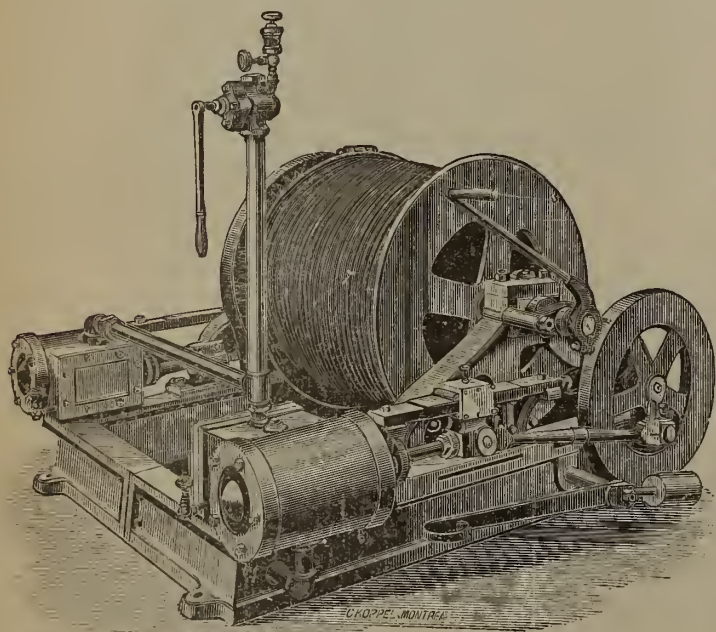
INGERSOLL
ROCK DRILL COMP'Y
OF CANADA
MANUFACTURERS OF

Rock Drills,
Air Compressors,
Steam & Horse Power Hoists,
BOILERS,
—AND—
GENERAL MINING
—AND—
Quarrying Machinery
—AND—
Contractors' Plant.



—ALSO—

Drill Steel, Wire Rope,
Derrick Castings,
Steam & Air Hose & Couplings,
Iron Piping, Fittings,
—AND—
ALL KINDS OF SUPPLIES
—FOR—
Miners & Contractors' Work.



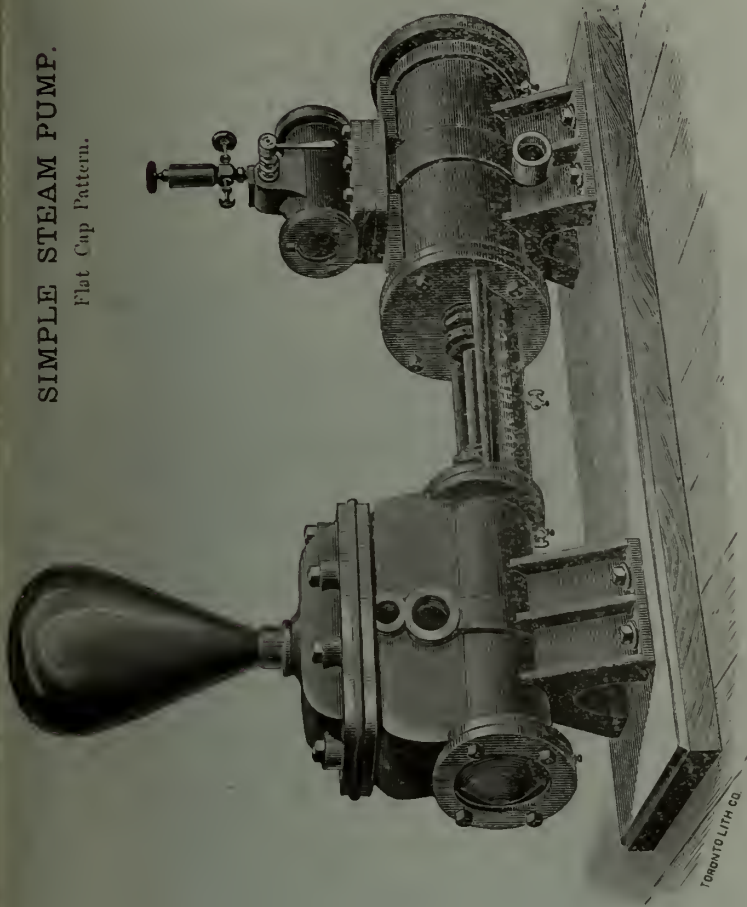
For Estimates, Catalogues and information address

Ingersoll & Rock Drill Co. of Canada.

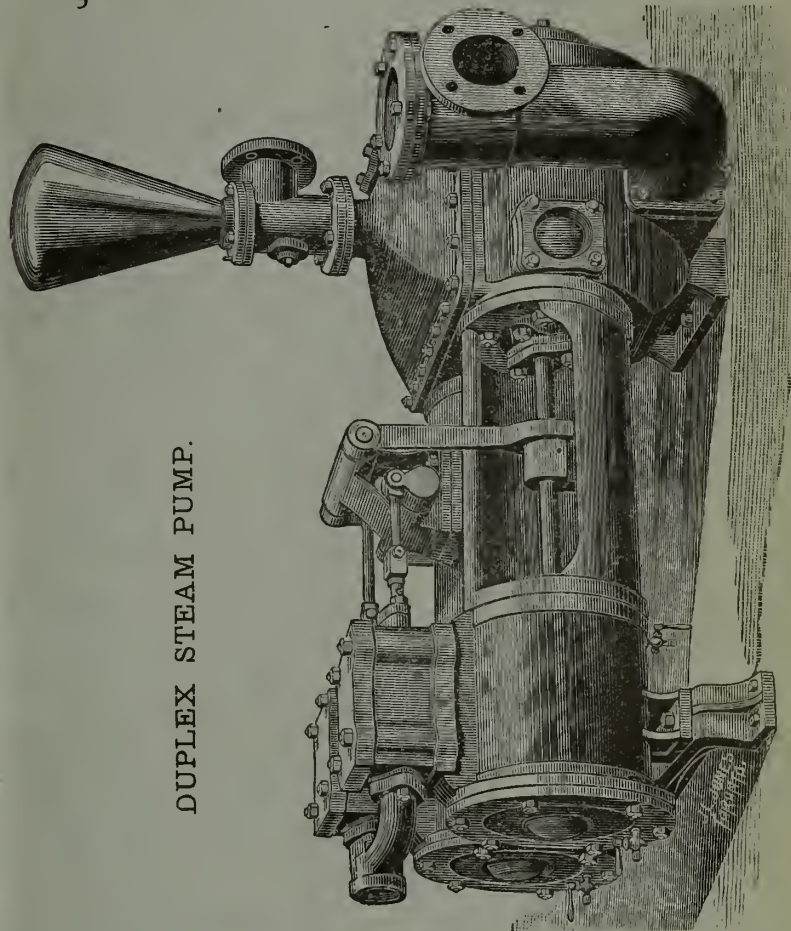
James Street, or P.O. Box 1942, Montreal.

Northey & Co's Steam Pump Works, TORONTO, ONT.

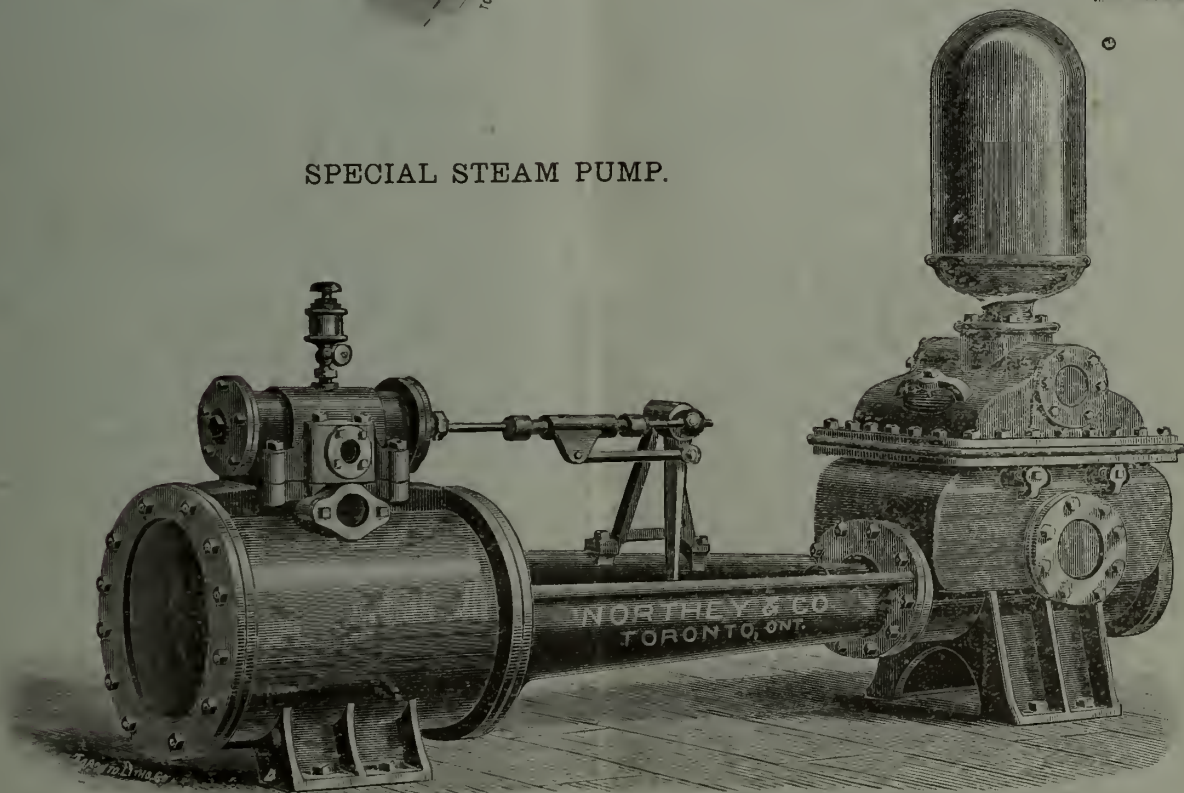
SIMPLE STEAM PUMP.
Flat Cap Pattern.



DUPLEX STEAM PUMP.



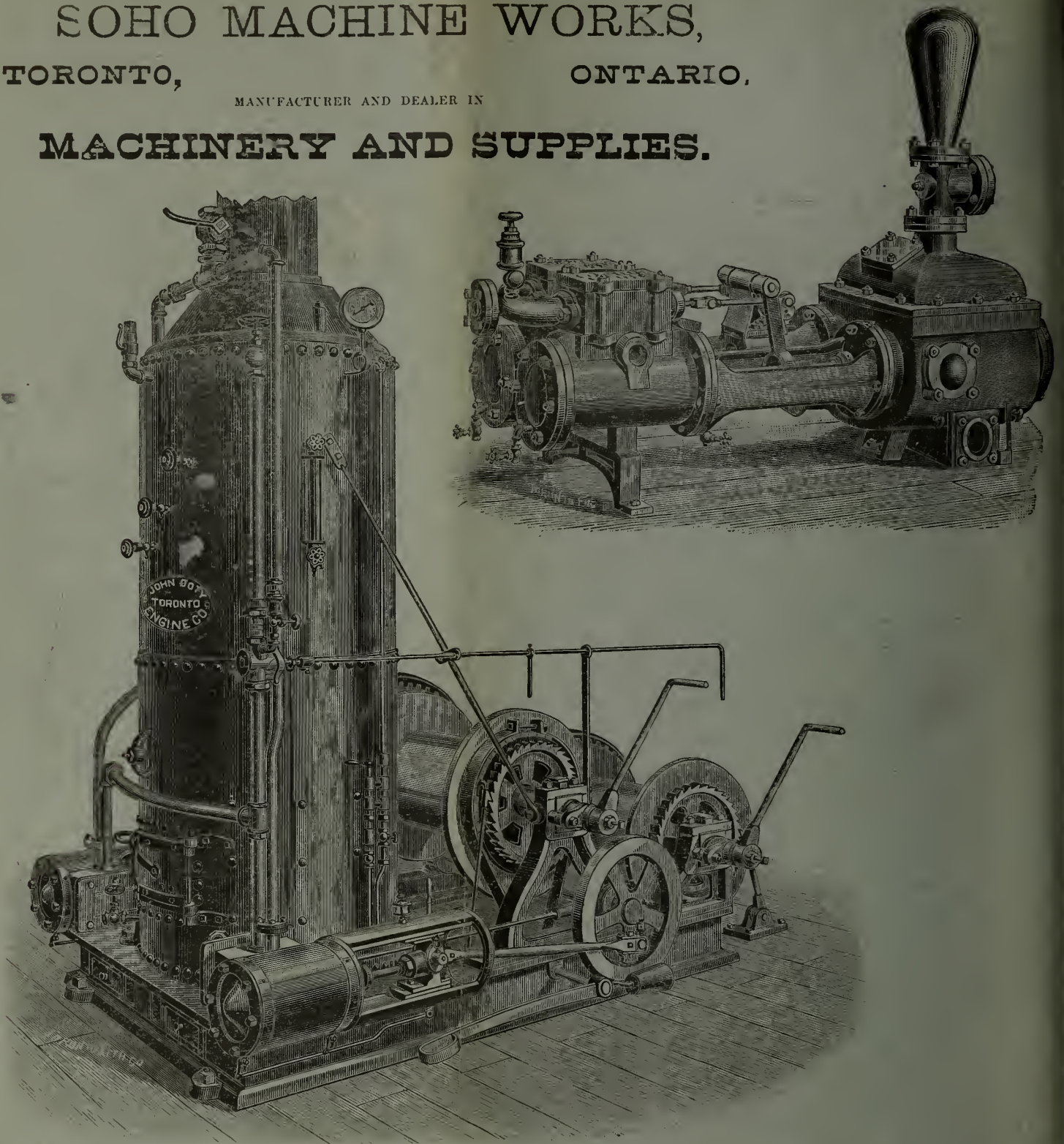
SPECIAL STEAM PUMP.



Steam Pumps of the best and latest designs for mining purposes, Boiler Feeding, Fire Protection, and General Water Supply, etc.

NORTHEY & CO.,
Mechanical  Hydraulic Engineers, Toronto, Ont.
WORKS—COR. FRONT AND PARLIAMENT STS.

A. R. WILLIAMS,
SOHO MACHINE WORKS,
TORONTO, ONTARIO,
MANUFACTURER AND DEALER IN
MACHINERY AND SUPPLIES.



Duplex Steam Pumps, all sizes. Every Pump Guaranteed.
VERY LOW PRICES.

Portable Engines, Hoisting Engines, Stationary Engines, Iron
and Wood Working Machinery, Ventilating Fans, Saw Mill
and Shingle Mill Machinery. Full lines of Machinery and
Supplies. Send for Catalogue.

MINING REVIEW

Canadian

Established 1882

Vol. VIII.—No. 4.

1889.—OTTAWA, APRIL—1889.

Vol. VIII.—No. 4

1889 CATALOGUE OF 200 PAGES, 1889
—A—
A TREATISE AND HANDBOOK
—ON—
Rock Drilling and Air Compressing
MAILED FREE.
RAND DRILL CO.,
23 PARK PLACE, NEW YORK

Hamilton Powder
COMPANY,
Manufacture Mining, Blasting, Military
and Sporting
Gunpowder,
DYNAMITE, DAULIN, and the new
ECLIPSE MINING POWDER

DOMINION AGENTS FOR
Safety Fuse, Electric Blasting
Apparatus, &c.
OFFICE
103 ST. FRANCOIS XAVIER STREET
MONTREAL.

BRANCH OFFICES & MAGAZINES
at all chief distributing points
in Canada.

CANADA ATLANTIC
RAILWAY.
THE SHORTEST PASSENGER ROUTE
BETWEEN
Ottawa and Montreal,
AND ALL POINTS EAST & SOUTH.

The only road in Canada running trains lighted
with electricity and heated by steam from the
engine. Luxurious Buffet Pullman Palace Cars
on all trains between Ottawa and Montreal. Only
line running through Sleeping Cars between

Ottawa, Boston and New York

And all New England and New York points.
Baggage checked to all points and passed by Customs in transit.

During season of navigation close connections
are made with Richelieu and Ontario Navigation
Company's Steamers at Coteau Landing, shooting
the St. Lawrence Rapids.

For Tickets, Time Tables and information apply
to nearest agent, or to

S. EBBS, City Passenger Agent,
24 Sparks St., OTTAWA.
GEO. H. PHILLIPS, Gen. Agent,
VALLEYFIELD.

A. E. CAIRNS, General Agent,
136 St. James St., MONTREAL.
Or at 260 Washington St., Boston, and
217 Broadway, New York.

PERCY R. TODD,
General Passenger Agent.
E. J. CHAMBERLIN,
General Manager,
General Offices, Ottawa.

THE CANADIAN RUBBER CO.
OF MONTREAL.

A. ALLAN, Pres. J. O. GRAVEL, Secy.-Treas. F. SCHOLES, M'g. Dir.

Manufacturers of

SUPERIOR QUALITY
RUBBER GOODS.

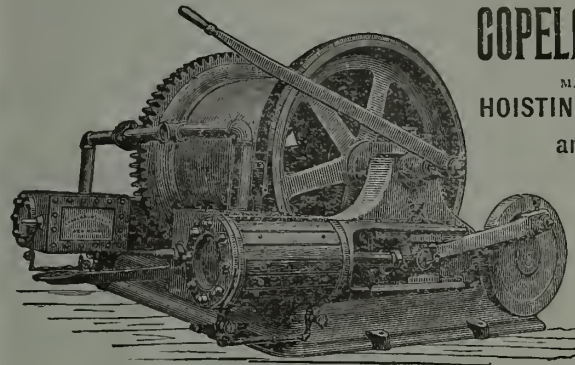
Our Rubber Belting is Un-
equalled in America.

Rubber Packings of all kinds.
Rubber Engine, Hydrant, Suction,
Steam, Brewers' and Fire Hose.
Moulded Goods of every description.

J. H. WALKER, Manager.



Western Branch cor. Front and Yonge Sts.,
TORONTO.



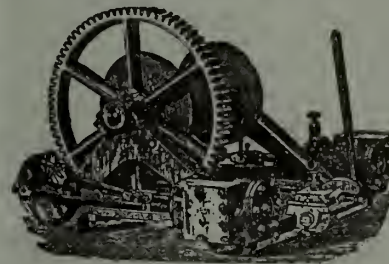
COPELAND & BACON

MANUFACTURERS OF
HOISTING ENGINES,
and **MINING PLANTS.**

85 Liberty St.
NEW YORK.

Send for Catalogue.

MILLER BROS. & MITCHELL



MANUFACTURERS OF
Steam Rock Drills

AND
HOISTING ENGINES,
Mining & Contractors' Plant
&c., &c.

110 TO 120 KING STREET, MONTREAL, QUE.

THE
BELL TELEPHONE CO.
OF CANADA.

ANDREW ROBERTSON, . . . PRESIDENT
C. F. SISE, . . . VICE-PRESIDENT
C. P. SCLATER, . . . SECRETARY-TREASURER

HEAD OFFICE, - MONTREAL.
H. C. BAKER, Manager Ontario Department,
HAMILTON.

This Company will sell its instruments at prices
ranging from \$10 to \$25 per set. These instru-
ments are under the protection of the Company's
patents, and purchasers are therefore entirely free
from risk of litigation.

This Company will arrange to connect places
not having telegraphic facilities with the nearest
telegraph office, or it will build private lines for
firms or individuals, connecting their places of
business or residences. It is also prepared to
manufacture all kinds of electrical apparatus.

Full particulars can be obtained at the Com-
pany's offices as above, or at St. John, N.B., Hal-
ifax, N.S., Winnipeg, Man., Victoria, B.C.

REMINGTON
STANDARD
TYPEWRITER

Miss Orr, Championship
of the world and Gold Medal
at Toronto, 13th August,
1888.

GEORGE BENGOUGH,
GENERAL AGENT,
36 King Street, TORONTO.



MISS M. E. ORR.

ALEX. FLECK, JUN.,
Manufacturer of every Description of
Mill Machinery

Water Wheels, Steam Engines,
Boilers, Derricks, Steam
Pumps and Mining
Machinery.

Brass and Iron Casting of every
Description.

VULCAN IRON WORKS, WELLINGTON ST
OTTAWA.

DYNAMO ELECTRIC
MACHINES and LAMPS



ARC and INCANDESCENT

FOR MINING PURPOSES

LIDGERWOOD MANUF'G CO.

96 LIBERTY ST, NEW YORK,

Largest Manufacturers in the United States of Hoisting Machinery of Every Description for Mines, Tunnel Work, Contractors, and General Hoisting Purposes.

IMPROVED HOISTING ENGINES

FOR MINING PURPOSES A SPECIALTY.

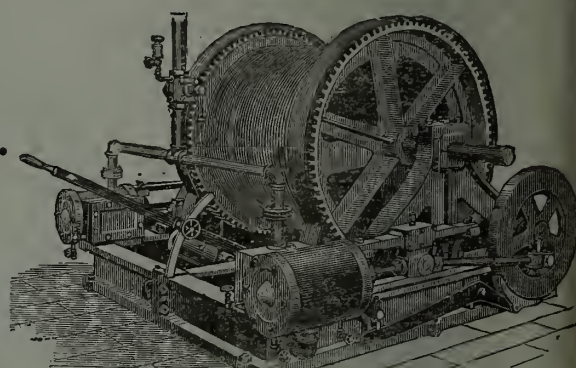
Over 5,000 Engines in Use!



FRICITION DRUM PORTABLE HOISTING ENGINE.

300 Styles
and Sizes.

Send for
CATALOGUE.



Double Cylinder Reversible Mine Engine.

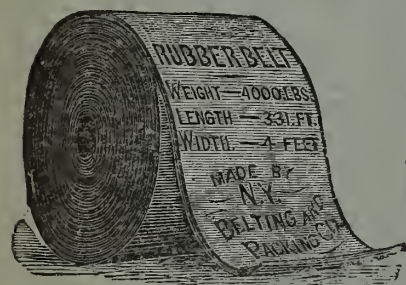
New York Belting & Packing Co.

15 PARK ROW, NEW YORK

JOHN H. CHEEVER, Treasurer.

J. D. CHEEVER, Dep'y Treasurer.

Oldest and largest Manufacturers in the United States of



RUBBER BELTING.

VULCANIZED RUBBER FABRICS

FOR MECHANICAL PURPOSES.

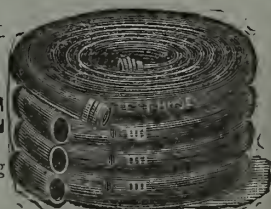
EXTRA RUBBER BELTING AND HOSE

FOR MINING PURPOSES.

CIRCULAR WOVEN SEAMLESS, ANTI-SEPTIC RUBBER LINED

"CABLE" HOSE AND TEST HOSE

For the use of Steam Engines, Force Pumps, Rolling Mills, Iron Works, Factories, etc. Woven in a superior manner to insure wear, compactness and durability.



"TEST HOSE."



Emery Vulcanite Wheel.

SOLID VULCANITE EMERY WHEELS

(Large Wheels made on iron centers)

Cuts Cooler and Freer than any other other wheel in the market.

W. D. ALLEN & CO.,
151 Lake St., Chicago.

European Branch: Pickhuben, , Hamburg Freihafengebeit), Germany.

H. D. EDWARDS & CO.,
Detroit.

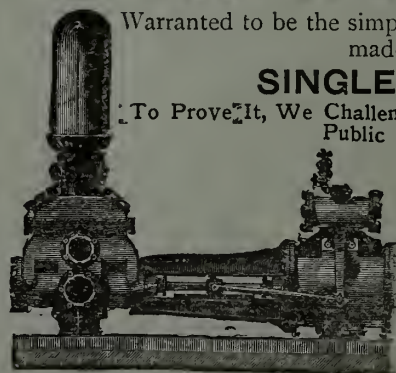
The M. T. DAVIDSON

IMPROVED MINING PUMP.

Warranted to be the simplest and most efficient Steam Pump made, whether it be

SINGLE OR DUPLEX.

To Prove It, We Challenge All Makers of Steam Pumps to a Public Competitive Test.



COMPOUND PUMPING ENGINES,

Obtaining a higher duty than any direct-acting pump made.

MANUFACTURED BY THE

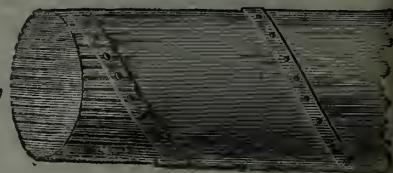
Davidson Steam Pump
COMPANY,

New York Office, - - - 77 Liberty Street.

ROOT'S SPIRAL RIVETED PIPE

FOR

Hydraulic Mining,
Water Works,
Ranch and Railroad
Water Supplies.



From 2 to 24 inches in diameter and 1 to 25 in length. Manufactured with fittings to suit, capable of withstanding any desired pressure.

ABENDROTH & ROOT MFG. CO.

28 Cliff Street, New York.

Chicago Branch, - - SMITH & KNAPP, 312 Dearborn Street

Francis D. Taylor
MINING ENGINEER,
ROCKVILLE, - ONTARIO

— The Mining of Iron Ores,
and the Manufacture of Iron and Steel.
— has had for many years the manage-
large mining enterprises in England
U. S. A.

CAMERON STEAM PUMP
SIMPLE, RELIABLE, COMPACT, DURABLE.
NO OUTSIDE VALVE GEAR.
THE A. S. CAMERON STEAM PUMP WORKS.
ADAPTED FOR ALL PURPOSES.
FOOT OF EAST 23rd STREET, NEW YORK.



**VALUABLE
PHOSPHATE LAND FOR SALE.**

On Kingston and Pembroke Railway, and adjoining large pro-
ducer. Also PYRITES IRON and other mines. Correspondence
solicited.

WM. H. WYLIE, Carleton Place, Ont.

TAYLOR McVEITY,
Barrister, Solicitor, &c.,

Supreme Court and Departmental Agent,
SCOTTISH ONTARIO CHAMBERS, OTTAWA.

WM. HAMILTON MERRITT, F.C.S.

Associate Royal School of Mines, &c.,
Mining Engineer and Metallurgist,
Will report on Mines and Mineral Properties.

ADDRESS:
15 TORONTO ST., TORONTO, ONT.

J. T. DONALD, M.A.,

Analytical Chemist and Assayer,
124 St. JAMES St. - MONTREAL.
Analyses and Assays of every description. Manufactur-
ing processes practically tested. Laboratory instruction
in Chemistry, Assaying and Mineralogy. Terms on
application.

**THE DOMINION
Leather Board Co.**

MONTREAL,

— MANUFACTURERS OF —

Leather Board & Stiffeners

ALSO OF

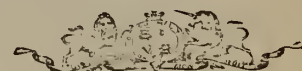
ASBESTOS MILL BOARD,

STEAM PACKING, and

FRICTION PULLEY BOARD.

Samples and prices furnished upon ap-
plication.

Please mention this paper.



ONTARIO

Mining Regulations.

The following summary of the principal provisions of the General Mining Act of the Province of Ontario is published for the information of those interested in mining matters in the Algoma District, and that part of the Nipissing District north of the Mattawan River, Lake Nipissing and French River.

Any person or persons may explore for mines or minerals on any Crown Lands surveyed or unsurveyed, not marked or stake out or occupied.

The price of all lands sold as mining locations or as lots in surveyed townships is two dollars per acre cash, the pine timber being reserved to the Crown. Patentees or those claiming under them may cut and use such trees as may be necessary for building, fencing or fuel, or for any other purpose essential to the working of mines.

Mining locations in unsurveyed territory shall be rectangular in shape, and the bearings of the outlines thereof shall be due north and south, and due east and west astronomically, and such locations shall be one of the following dimensions, viz: eighty chains in length by forty chains in width, containing 320 acres, or forty chains square, containing 160 acres, or forty chains in length by twenty chains in width, containing 80 acres.

All such locations must be surveyed by a Provincial Land Surveyor, and be connected with some known point or boundary at the cost of the applicant, who must file with application surveyor's plan, field notes and description of location applied for.

In all patents for mining locations a reservation of five per cent. of the acreage is made for roads.

Lands patented under the Mining Act are free from all royalties or duties in respect to any ores or minerals thereon, and no reservation or exception of any mineral is made in the patents.

Lands situated south of the Mattawan River, Lake Nipissing and French River are sold under the Mining Act at one dollar per acre cash.

Affidavits showing no adverse occupation, improvement or claim should accompany applications to purchase.

A. S. HARDY,

Commissioner

Department of Crown Lands, Toronto.

The Canada Co.

issue Licences to Prospect or work Minerals on any of their Mining Lands and Mineral Reservations,

Covering nearly a

Quarter of a Million Acres

Eastern Ontario, and principally within the belts containing

Phosphate, Gold, Galena, Plumbago, Mica, Marbles, Building Stone, and other valuable Minerals.

List of lands and terms apply to the company's Mining Inspectors,

H. T. STRICKLAND,
Peterborough, Ont.,

lands in the County of Hastings and ward, and to

ANDREW BELL, P.L.S.,
Almonte, Ont.,

lands East of the County of Hastings

TO MINERS AND OTHERS.

Lanternman & Powers,

VULCAN BOILER WORKS,

428 and 340 Wellington St., Ottawa.

MANUFACTURERS OF

IRON AND STEEL BOILERS

EVERY DESCRIPTION.

Shanks, Girders, Iron Roof-
ing, Bank Vaults, Smoke
Stacks

— AND ALL KINDS OF —

SHEET IRON WORK.

Repairs Neatly and Promptly Executed

**MANUFACTURERS OF MACHINERY
and dealers in Steel Tools and
GENERAL MINING SUPPLIES**

will find

THE CANADIAN MINING REVIEW

The Best Advertising Medium in Canada.

The REVIEW is the Official Organ of the
GOLD MINER'S ASSOCIATION OF NOVA SCOTIA
and is the representative exponent of the
PHOSPHATE, ASBESTOS, COPPER, SILVER, IRON
and other Mineral Interests of the Dominion.

THE ONLY MINING JOURNAL IN CANADA,

Established 1882,

Subscription Price, - - \$150, in advance.

ADVERTISING RATES—Transient, 15 cents
per line; special contracts made for periods ex-
tending over three months.

PORTABLE ENGINES AND SAW-MILLS

Of all capacities—from 3000 feet of lumber and up per day.

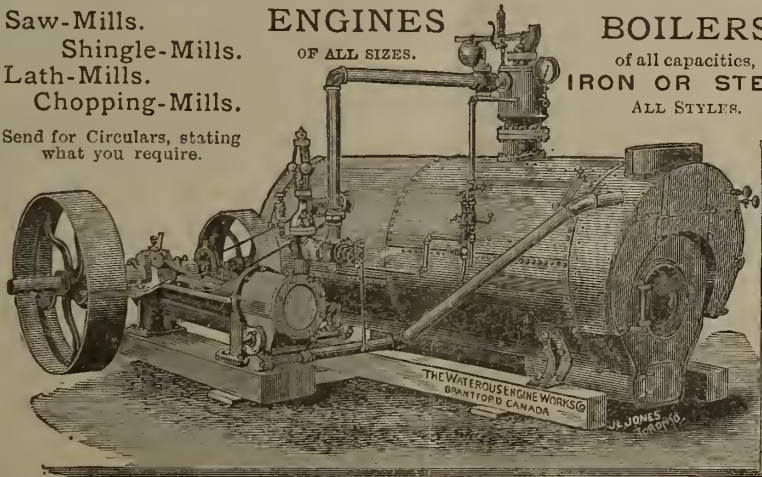
Saw-Mills.
Shingle-Mills.
Lath-Mills.
Chopping-Mills.

ENGINES
OF ALL SIZES.

BOILERS

of all capacities,
IRON OR STEEL,
ALL STYLES.

Send for Circulars, stating
what you require.



Waterous Engine Works Co. Brantford, Canada.
St. Paul, Minn., U.S.A.

ASBESTOS.**THEO. HAMEL,**

44 Mountain Hill, Quebec,

SOLE ASBESTOS MANUFACTURER in CANADA

Write for prices and catalogue. Use Asbestos and save your money. Applied on boilers and Steam pipes it will prevent them from rusting and will economize 33% on fuel.

WILSON & GREEN,**Commission Merchants,**

PHOSPHATE SHIPPERS.

AGENTS HIGH ROCK MINE.

17 St. Sacrament St., - - MONTREAL.

EDMUND SPARGO,

Consulting and Mining Engineer, 3 Cable Street, Liverpool.

Owners of or Investors in Metalliferous Mines, Slate, Granite, and other Stone Quarries, Brick, Terra Cotta, Fire and other Clays and Mineral Estates in general, requiring reliable and sound advice either in the Purchase or Disposal thereof, should consult E.S., who has executed important professional Commissions in Germany, Austria, Hungary, France, Belgium, Spain, Portugal, Sweden, Norway, and in the various Mining Districts throughout Great Britain and Ireland. Telegraphic Address: "Spargo," Liverpool. Bankers, National Provincial Bank of England, Liverpool.

THOMAS HEYS,

Analytical and Consulting Chemist and Assayer.

References are kindly permitted by the following: Messrs. Gooderham & Worts, Toronto, Limited; Messrs. P. R. Lamb & Co.; John Livingston, Esq., Dominion Bolt Co.

Assay and Analytical Laboratory } TORONTO.
16 King St. West, opposite the Rossin House, }

J. LAINSON WILLS,

F. C. S., ETC.

Manager of the Canadian Phosphate Co. (Lim.),

Will shortly be disengaged, and offers his services to examine and report upon Mines and Mining properties. Advice given on Chemical and Metallurgical processes.

SPECIALTIES: PHOSPHATE AND GOLD.

TELEGRAPHIC OR POSTAL ADDRESS:

WILLS, BUCKINGHAM, P.Q.**WANTED.**

A FIRST CLASS

Phosphate Property

If not absolutely first class will not be looked at. Particulars to

ROBERT H. JONES,

CANADIAN MINING AGENCY,

82 Queen Street, Cheapside, London, England.

Ottawa Boiler and Bridge Works

478-480-482 } OTTAWA { 476-478-480
Maria St. } Gloucester St.

W. J. CAMPBELL & CO

MANUFACTURERS OF

STEAM ENGINES, BOILERS,
TANKS, MINING PAILS,
DUMP-CARS

And every description of Wrought
Iron Work.

MINING WORK A SPECIALTY.

N.B.—Every Attention given to re-
pairing by Experienced Workmen.

JAMES HOPE & CO.

BOOKSELLERS,

Stationers, Bookbinders and Printers,
OTTAWA.

SPEIGHT & VanNOSTRAND,

*Dominion and Provincial Land Surveyors,
Draughtsmen, Valuers, &c.*

OFFICE: ROOM "J," FIRST FLOOR, TORONTO ARCADE,
YONGE ST., TORONTO.

Surveys, Plans, Descriptions of Properties, etc., promptly executed.
Timber Limits and Mining Claims Located.

MILLAR & CO.**General Merchants & Shipping Agents**

ATLANTIC CHAMBERS,

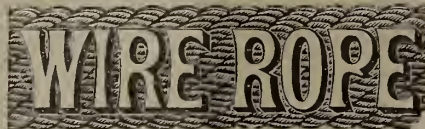
209 COMMISSIONER ST., - MONTREAL

Cable address, "Hoyer, Montreal." P.O. Box 1095.

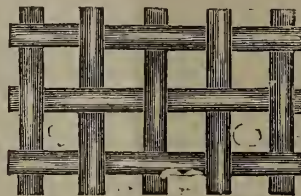
AGENT for The Canadian Phosphate Co., Ltd., of London, Eng.,
The Montreal Union Abattoir Co., of Montreal, Can.

English Correspondents Messrs. Couper, McCarnie & Co., Lon-
don, England.

DEALERS in Canada Phosphate, Ground Phosphate, Sulphate of
Ammonia, Nitrate of Soda, Spent Bone Black, Hoofs and
Horns, Fertilizers, Tankage, Dried Blood, Grease, Bones,
Hair, etc., etc., etc.



For Mining Hoisting Derricks, etc.

**Strong Wire Cloth and Screens**

For Mining, etc., manufactured by

B. Greening & Co.

HAMILTON, ONT.

NATIONAL COLONIZATION

Lottery!

UNDER THE PATRONAGE OF

THE REV. FATHER LABELLE.

Established in 1884 under the Act of Quebec, 31 Vict.,
Chap. 36, for the benefit of the Diocesan Societies
of Colonization of the Province of Quebec.

CLASS D.

DRAWINGS ON THIRD WEDNESDAY IN EVERY
MONTH AT 2 P.M.

Prizes value \$50,000

Capital Prize: 1 Real Estate worth \$5,000.

LIST OF PRIZES.

1 Real Estate worth	\$5,000	\$5,000
1 Real Estate worth	2,000	2,000
1 Real Estate worth	1,000	1,000
4 Real Estates	500	2,000
10 Real Estates	300	3,000
30 Furniture Sets	200	6,000
60 Furniture Sets	100	6,000
200 Gold Watches	50	10,000
1000 Silver Watches	10	10,000
1000 Toilet Sets	5	5,000

2307 Prizes worth \$50,000

Tickets, \$1.00!

Offers are made to all winners to pay their prizes cash,
less a commission of 10 p. c. Winners' names not pub-
lished unless specially authorized.

S. E. LEFEBVRE, Secretary.

Office: 19 St. James St., Montreal, Can.

W. Blakemore, F.G.S., M.E.,
Member of I. & S.I.

A. Montgomery Evans, M.
of Canada & U.S.

BLAKEMORE & EVANS,
MINING & CIVIL ENGINEER
Exchange Buildings, Cardiff, S.W.

LONDON OFFICE:

Robert H. Jones, 82 Queen St., Cheapside, London, E.

Reports, Estimates, and Valuations made on Iron and Steel Work
Blast Furnaces, and all classes of Mining Properties.

CANADIAN BUSINESS PROMPTLY ATTENDED TO**To Prevent Boiler Explosions**

And other accidents to steam boilers, and to secure
economy in working, insure with

**THE BOILER INSPECTION
AND INSURANCE COMPANY OF CANADA.**

Sir Alex. Campbell, K.C.M.G., | John L. Blaikie, Esq.
President. Vice-Pres.

HEAD OFFICE: - - - - - TORONTO

G. C. ROBB, Chief Engineer.

A. FRASER, Sec'y-Treas.

ORFORD COPPER CO.,**COPPER SMELTERS.**

Works at Constable's Hook, N.J., opposite new Bright-
ton, Staten Island. Copper Ore, Mattes, or Bullion
purchased. Advances made on consignments for re-
fining and sale. Specialty made of Silver-Bearing
Ores and Mattes.

SELL

INGOT AND CAKE COPPER.President, **ROBERT M. THOMPSON,**Treasurer, **G. A. LAND**

Office, 37 to 39 Wall Street, New York.

Robin & Sadler,

MANUFACTURERS OF

LEATHER BELTING.

TRY OUR

Waterproof Belting,

Just the thing for Mining Machinery.

MONTREAL,

2518, 2520, 2522 Notre Dame St.

TORONTO,

129 Bay Street.

STEEL IN STORE
"JESSOP'S"

Standard Durable Cast Steel. Best value for consumers.
Also Machinery Steel.

A. C. LESLIE & CO.,
Montreal and Toronto.

T. D. LEDYARD,

DEALER IN MINERAL LANDS
4 ONTARIO CHAMBERS, TORONTO.

Will buy undeveloped iron ore and other mineral properties.
WANTED. — Deposits of Magnetic Iron Ore, Red Hematite,
Brown Hematite, Galena, Iron and Copper Pyrites, Mica, Soap-
stone, Marble, Gypsum, Baryta. Samples can be sent by Sample
Post for 1 cent for 4 oz. or up to 24 oz. in weight.
Information regarding mines cheerfully given. Corresponden-
solicited. Crown Land Business attended to.

CHEMICAL APPARATUS! OF EVERY DESCRIPTION.



Glass, Porcelain, Stoneware, Platinum Crucibles of every sort, Analytical Scales and Weights, Fine Chemicals and Reagents, including Volumetric Solutions. Every requisite for Analysis or Experiment. For Sale by

LYMAN, SONS & CO.,
334 St. Paul St., Montreal.

Illustrated Catalogue mailed on receipt of 10c. or Business Card.

Boiler For Sale.

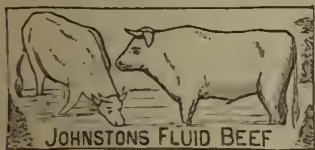
N EIGHTY H.P. TUBULAR STEEL BOILER made by W. C. White, Montreal, 15 ft. x 5 ft. 4 in. eighty 3 1/2 in. tubes; smoke stack 45 ft. long; guyards 1 guys. Very little used. Equal to new. Price on rs, \$600. Address

P. O. Box 6,
MONTREAL.

NEVER TRAVEL

WITHOUT A SUPPLY OF

JOHNSTON'S



FLUID BEEF

IT MAKES

DELICIOUS SANDWICHES

SPREAD ON THIN SLICES OF BREAD AND BUTTER

A STRENGTHENING BEEF TEA

IS MADE IN A MINUTE BY MERELY ADDING
BOILING WATER; IT IS

MEAT AND DRINK.

Victor Electric Fuses.

Superior to all others for Exploding any make of Dynamite, High explosives, or Gelatine Powder. Each Fuse is tested and warranted extra strong and waterproof. Low grades of Dynamite powder will do ten per cent. more execution if detonated with Victor Electric Fuses.

VICTOR BLASTING MACHINES.

Latest improvements, made in three sizes, easy to operate, strong and durable. No expensive repairs, low in price, will fire any make of Electric Fuses.

MANUFACTURED ONLY BY

JAMES MACBETH & CO.,

128 Maiden Lane, N.Y., U.S.A.

Send for Catalogue.

FOR SALE.

A COAL MINE IN CAPE BRETON,

Area, 970 acres, underlain by 6 or 7 beds of the best Coal in Nova Scotia. The property is estimated to contain from 50 to 60 million tons of Coal. No Coal Mine can be more easily or cheaply operated. The angle of dip is 6 degrees, and the rock stratification is remarkably even and without fault or break.

Apply to

ALEXANDER CAMPBELL,
Annapolis Royal, N.S.

LEDOUX & COMPANY,

10 CEDAR ST., NEW YORK.

Engineers, Metallurgists & Assayers

Public Ore Sampling and Storage Works.

All the principal buyers of furnace materials in the world purchase and pay cash against our certificates of assay, through New York banks.

By special permission of the Secretary of the Treasury of the United States, cars of ore or copper matte passing through in bond can be opened and sampled at our works.

Consignments received and sold to highest bidder. Send for circular giving full particulars.

Mines Examined and Sampled. Assays and Analyses of all kinds.

DOMINION ASSAY OFFICE, Gold and Silver Ores and Bullion

ASSAYED, REFINED AND PURCHASED.

Mining Properties bought, sold and examined. Fifteen years experience in Australia, New Zealand and California.

44 VICTORIA STREET, - - - TORONTO.

H. ANN, PROP.

The Ontario Mining Company (Limited) are applying for a charter of incorporation for the purpose of acquiring and working mineral lands in the Province of Manitoba. The capital stock is to be \$20,000, in 2,000 shares of \$10 each. The applicants are:—Hon. Gilbert McMicken, Winnipeg; Hamilton Grant McMicken, Winnipeg; George Heenan, Rat Portage; John Albert Kirk, Stratford, Ont.; A. J. Parsons, Rat Portage; George Clayton Frisbie, Rat Portage; Mortimer Marcus Wheeler, St. Paul, Minn.; A. T. R. Blackwood, Winnipeg; J. H. Challoner, Rat Portage; J. G. Bennett, Winnipeg; A. C. McMicken, Winnipeg; C. S. Hoare, Winnipeg; G. H. R. Wainwright, Winnipeg; William Blackwood, Winnipeg; Herbert James Belch, Winnipeg, and the Hon. Thos. Howard, Winnipeg; of whom Hon. Gilbert McMicken, H. G. McMicken, J. H. Challoner, George Heenan and Mortimer M. Wheeler are to be the first or provisional directors of the company.

Edison's New Method of Separating Iron Ore.—Many iron men and others continue to flock to a secluded section of Washington Township, where experiments are soon to be made with one of Edison's greatest and most recent inventions, known as the Edison concentrator, the object of which is to concentrate the real ore dug from a mine, and get rid by mechanical means of all dirt and earthy matter that interferes with smelting. This machine has been successfully tested in Mr. Edison's laboratory. It is claimed that it will reduce immensely the cost of smelting and bring into use ores that cannot now be profitably worked. New York capitalists have purchased eight acres of iron ore land, where the experiments will be made. Building and machinery are now being put up at a cost of \$35,000. The invention, it is believed, will work a revolution in the iron trade. The working of the ore concentrator is not to be a secret, as supposed. The rock containing the ore, after passing through the crusher and broken to the size of an egg, is dumped into a large hopper. From here it drops down an incline within a few inches of a powerful magnet. This will be so heavily charged as to draw the ore from its course into one channel, and the rock and other foreign elements contained in the ore are permitted to pass through another channel into the refuse pile.

ALEX. RANKIN,

20 Toronto Street, Toronto Ont.

Agent for sale of Mines and Mineral Lands.

CORRESPONDENCE SOLICITED.

Agents in England and New York.

E. H. SARGENT & CO.,

IMPORTERS AND DEALERS IN

ASSAYER'S MATERIALS,

Chemicals and Laboratory Supplies.

125 State Street,

CHICAGO.

HARRIS & CAMPBELL

Latest Designs in Drawingroom, Diningroom and Bedroom

FURNITURE

With improved Steam Machinery our facilities for manufacturing Cabinet Goods are complete. Our upholstery Department is well stocked with latest imported patterns.

Corner QUEEN & O'CONNOR Sts.
OTTAWA.

THIS YEAR'S

MYRTLE

CUT AND PLUG

Smoking Tobacco

FINER THAN EVER.

SEE

T & B

In Bronze on Each Plug and Package.

THE DOMINION

SAFETY BOILER CO.

MANUFACTURERS OF

The "Field-Stirling" Patent High Pressure Boiler,

The Safest and Cheapest Steam-Generator now in Use.

This Boiler is unusually durable, being made of the best steel and wrought iron exclusively. No cast-iron is employed. It is simple in construction, has a rapid, well-defined circulation, and a large cool mud-drum, where all impurities are collected to be blown off. All parts of the Boiler are readily accessible for the closest inspection. It has great excess of strength and is not liable to be strained by unequal expansion. The water space is divided into sections so arranged that NO EXPLOSION IS POSSIBLE.

Some of Our Leading Customers:

The J. A. Converse Mfg. Co. (A. W. Morris & Bro.), Montreal; The Canada Sugar Refining Co., Montreal; The Pillow and Hersey Mfg. Co., Montreal; The Berthier Beet Root Sugar Co., Berthier, Que.; The Imperial Insurance Co., Montreal; The Massey Manufacturing Co., Toronto; The Acadia Coal Co. (Ld.), Stellarton, N.S.; Canada Paper Co., Windsor Mills, Que.; Royal Electric Co. (Central Station), Montreal; Dodge Wood Split Pulley Co., Toronto, and a repeat order from A. W. Morris & Bro., after five months' experience; Ingersoll Rock Drill Co. of Canada.

We guarantee Dry Steam and Great Economy of Fuel. Correspondence Solicited.

J. FRASER TORRANCE, M.E.,

P.O. Box 1707, Montreal.

Manager.

If you want

BAGS

FOR PACKING

ASBESTOS, PHOSPHATES, ORES, &c.,

Send to us for Samples and Prices.

Every quality and size in stock.

Specially strong sewing for heavy materials.

Lowest prices compatible with good work.

We now supply most of the Mining Companies, and those who have not bought from us would find it to their advantage to do so.

THE CANADA JUTE COMPANY (LTD.)

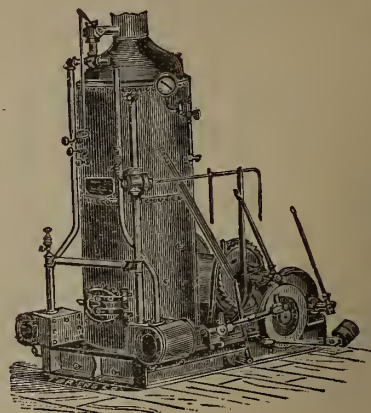
17, 19 & 21 ST. MARTIN STREET,

Established 1882.

MONTREAL.

M. BEATTY & SONS

WELLAND, ONT.



HOISTING

ENGINE

ENGINE

FOR

Mines

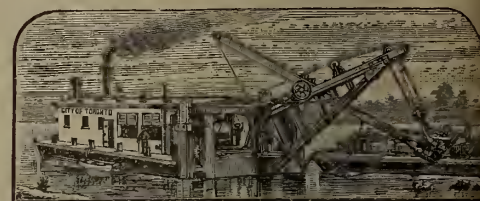
AND

Incline

Horse-Power Hoisters,

Stone Derrick Irons,

Centrifugal Pump



DREDGES,

DERRICKS

STEAM SHOVELS,

And other Contractors' Plant.

AMALGAMATING MACHINERY.

Stamp Mills for Wet or Dry Crushing. Huntington Centrifugal Quartz Mill. Drying Cylinders. Amalgamating Pans, Settlers, Agitators and Concentrators. Retorts, Bullion and Ingot Moulds, Conveyors, Elevators, Bruckners and Howell's Improved White's Roasting Furnaces, Etc.

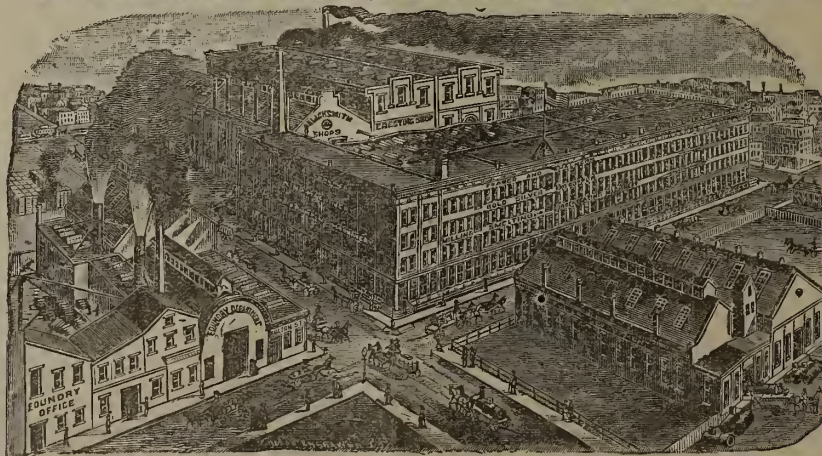
CONCENTRATING MACHINERY.

Blake, Dodge and Comet Crushers, Cornish Crushing and Finishing Rolls, Hartz Plunger and Collom Jigs. Frue Vanner & Embrey Concentrators, Evans', Calumet, Collom's and Rittenger's Slime Tables. Trommels, Wire Cloth and Punched Plates. Ore Sample Grinders and Heberle Mills.

FRASER & CHALMERS, MINING * MACHINERY.

Improved Corliss and Slide-Valve Steam Engines,
Boilers--Horizontal, Vertical and Sectional,
IMPROVED STEAM STAMPS.

Hoisting Engines, Safety Cages,
Safety Hooks,
Ore Cars, Water and Ore Buckets,
Air Compressors, Rock Drills, Etc.
General Mill and Mining
Supplies, Etc.



Pumping Engines and Cornish
Pumping Machinery,
Improved Water Jacket
Blast Furnaces for Calena and
Copper Ores.
Slag Cars and Pots,
Roots & Baker Pressure Blowers,
Suspended Tramways.

Sectional Machinery for Mule-Back Transportation.

General Offices and Works: FULTON & UNION STS., CHICAGO, ILL.

BRANCH OFFICES: NEW YORK, Room 43, No. 2 Wall St. DENVER, COLO., 1316 Eighteenth St. SALT LAKE CITY, UTAH, 7 West Second South St. LONDON, ENGLAND, 23 Bucklersbury, E. C. CHIHUAHUA CITY, MEXICO, No. 11 Calle de Juarez. LIMA, PERU, South America. JOHANNESBURG, TRANSVAAL, South Africa.

The Canadian Mining Review

CONDUCTED BY . . . B. T. A. BELL

OFFICES:

UNION CHAMBERS, 14 Metcalfe St.

OTTAWA.

Vol. VIII. APRIL, 1889. No. 4.

Our Libel Suit.

We were not a little amused, a few days ago, to read in the *Montreal Gazette* that a certain Charles Lionais, mine promoter and manager, proposed to enter suit against the REVIEW for the fabulous sum of *fifty thousand dollars*, being damages claimed for an alleged libellous paragraph which appeared in our last issue. There is certainly nothing small about Mr. Charles Lionais. The item in question was published in our Phosphate Notes, and was as follows:

Mr. C. Lionais, formerly superintendent of copper and asbestos mines in the Eastern townships, is reported to be making elaborate preparations for commencing work on some lots adjoining the Blackburn estate. Telephone communication to the station, electric light and a costly plant are said to be in course of erection. Perhaps it might be well to ascertain and prove the true value of the property before going to all this expense. Extravagance and illadvised management have in the past wrought enough harm to our Canadian mines, as a number of properties with which Mr. Lionais is not unacquainted, can testify.

Mr. Lionais, it is stated, takes exception to this simple, outspoken paragraph on the ground that owing to the extensive circulation of the REVIEW in Great Britain and the United States it will have the effect of deterring capitalists from investing their money in his property."

It will be observed that we have said nothing against the *value* of the property, other than to suggest that being comparatively undeveloped and entirely unproved it does not, in its present state, warrant anything like the elaborate and costly works which are reported to be in course of construction upon it. Dr. Selwyn, the able Director of the Geological Survey, made a thorough examination of the property in 1887, and a few weeks ago having occasion to be in the district again, became acquainted with what is now going on there. Writing under date of 18th Dr. Selwyn says: "I have no hesitation in saying that unless some extensive developments, of which I am not aware, have been made since I examined the property in 1887, I do not consider such expenditure as you refer to advisable. The money would, I consider, be more wisely expended in actual mining operations to develop the undoubtedly good indications which there are on the property."

We could cite many similar expressions of opinion by practical engineers and mining men did we consider it at all necessary to do so.

It is the duty of the mining press to bring about a truthful and honest representation of all mining ventures whether they be mines fully developed or mere "prospects" about to be, or partly opened up, in order that a fair bargain may be arranged between the vendor and the purchaser. Investors must be warned against the payment of excessive figures for undeveloped properties—no matter how good indications they may contain—until sufficient work has been done to prove them *mines*. Mr. Lionais is credited with being a miner of "large and varied experience." Has he forgotten the history of mining all the world over, and the many deplorable instances in Canada where extravagance, incompetence and visionary management have resulted in a lamentable loss of capital? Surely

he must be aware that perhaps no other line of enterprise has suffered so much from a total disregard of the fundamental principles of business.

At the instigation of Mr. C. B. Falardeau, a number of Mr. Lionais' friends have written evidently with the object of inducing us to withdraw the paragraph. We will do nothing of the sort; and if Mr. Lionais is really serious, and is not catering for a little cheap notoriety, we will meet him in Court, and substantiate any opinion we may have expressed in these columns.

Another Bubble Burst.

The collapse of the Mineral Phosphate Company and its promoters has lately been the chief topic of conversation among mining men and the phosphate trade generally. It is admitted by everyone that the price asked for the property was ridiculously high, and far in excess of its true value, while the many discrepancies between statements and facts apparent in the Prospectus have been much commented upon. *Appropos* of this concern, an English exchange has the following pertinent remarks:

"We observe that the person upon whose figures the directors solely rely for the estimate of dividend is a Mr. McAndrew. A foot note informs us that Mr. McAndrew has been good enough to accept the appointment of manager. Is this gentleman a storekeeper at Buckingham Village, near by the property? And, if so, what does he know about phosphate mining? Mr. McAndrew bases his calculations upon a selling price of 1s. 2½d. per unit, or £5 1s. 6d. per ton of 84 per cent. phosphate. Where does he get his figures, and how comes it that the directors have accepted them as correct? We invite them to say whether it is not the fact that this price has not been obtained for the last four or five years, and that the present price is only 1s. per unit, or £4 4s. per ton? If we are right, then over 25 per cent. must be deducted from the net profits as estimated in the prospectus."

This should be a lesson to those stupid persons who place an infinite reliance upon the gullibility of the English investor, and who overreach themselves in order to "get ahead" of their neighbors. While the failure of the concern does not come as a surprise, it is greatly to be deplored, inasmuch as it may seriously affect the disposal of many excellent properties now in the market.

Mining in Nova Scotia during 1888.

The Annual Report of the Commissioner of Public Works and Mines, Nova Scotia, lies on our table, and containing as it does a large amount of valuable statistics and information respecting mining matters in that province, its summary is laid before our readers in as concise a form as possible. There is an increase in the yield of six and a decrease in five of the minerals recorded in the tables for 1888. Of gold, 22,407 ounces are returned as against 21,211 in 1887, the wet summer having militated against a larger yield, as in a converse ratio the dry season operated detrimentally in the previous year. Numerous fresh discoveries are reported from all points on the auriferous belt, and some of them it is confidently believed will prove valuable. All the gold mining of Nova Scotia is conducted by means of crushing, and placer diggings are unknown. Despite some

failures, mining business may be said to have improved, and outside capitalists are looking for investments. Salmon River, Carribou, Whiteburn, Lake Catcha and Stormont are the districts reported to have in their respective order afforded the highest returns.

The coal trade at the mines is almost the same as in 1887, the sales reported in 1888 being 1,576,692 tons against 1,519,684 in the previous year, the increase being 57,008 tons. There was an increase in home consumption, an increase of 28,000 tons in sales to Quebec, an increase of 28,000 tons in New Brunswick, and a large falling off in sales to the United States, amounting to 43,694 tons. The cause of the latter is not stated. During the past season the regular manufacture of coke has been commenced at the Gowrie mines, Cape Breton, on a small scale, and several hundreds of tons were shipped. This coke is largely used in copper concentration and smelting operations in Newfoundland. The inspector of mines seems to have exercised his duties very carefully, and the accidents reported have not been as fatal as in former years. Reports of coal discoveries are mentioned in Colchester and Cumberland counties, and should the tests now being made prove satisfactory the localities will be found to be advantageously situated, as the Intercolonial Railway runs through the district. Mention is made of the necessity of a constant supervision over pit ropes, and testing those made of wire. Attention is called to a new rope known as the "Lang locked wire rope," in which the wires are so moulded as when put together to make practically a homogeneous flexible rope, which is reported to have stood in use twice as long as the ordinary rope under similar conditions of wear and tear.

Of iron, 41,619 tons were mined by the Londonderry Co. and smelting operations were satisfactorily conducted, the yield showing a slight decrease compared with the previous year. Copper mining in Nova Scotia is in its infancy, but much interest was shown in the search for workable deposits of this ore, and the Report states that the question of their existence is satisfactorily answered in the affirmative. The lead mine at Smithfield is still awaiting capital to work it. The export of gypsum is on the increase; manganese shows a great falling off, owing to the great depreciation of its value in the early part of the year. The increase that has since occurred is expected to revive the workings of this mineral. Antimony is still only produced at Rawdon. In addition to the above mentioned minerals 1,100 tons of barytes, 1,760 tons of grindstones, 169 tons of mouldings and, and a large quantity of limestone are recorded as helping to swell the value of the products of the mine in Nova Scotia in 1888, and the Report closes with a table which gives the value of the exports from Halifax. This, however, representing only one fact, is very apt to be misleading, as a casual reader might look upon it as representing the *total* exports of the

province. It seems to us it would have been better either to give the total export of all the ports of the province, or else none at all. We merely allude to this to guard readers of the Report against an error they might unwittingly fall into.

Mines and Mining on Lake Superior.

The extent of area dealt with in the report by Mr. E. D. Ingall, M.E.A.R.S.M., being Part H of the Annual Report of the Geological Survey of Canada, just issued to the public, covers a tract of country from 81 to 91 degrees of longitude west along the shores of Lakes Huron and Superior, including the silver bearing area around Port Arthur, and about 3 degrees of latitude in the same space. Its geological features are treated, and its mineral resources are enumerated, viz: iron, magnetic and hematite; copper; silver; gold, both free and in its baser form; zinc blende, and a variety of other useful but less generally important minerals such as ornamental stones, mineral pigments, &c. A succinct history of the region follows, dating back forty years, when Sir William Logan called attention to it, and subsequently explored it, down to the discovery of the rich silver ores of Rabbit Mountain in 1882, and the still more recent operations of the present time. The opening of the C. P. R. and its facilities for communication with this district are compared with the former means of communication by water routes only, and the isolation which originally marked that district rendered all efforts to develop it difficult in the extreme. Under the existing mining laws large tracts become tied up for speculative purposes, and a change in the laws is needed "to ensure actual working and to foster discovery by rendering it as easy as possible for the explorer to get the *full* benefit of his toilsome and dangerous efforts." The area of the silver bearing rocks is estimated by Mr. Ingall at approximately 1200 square miles, and a map accompanies this estimate, the special groups being enumerated as the Coast, the Port Arthur, the Rabbit Mountain, the Silver Mountain, and the White Fish Lake group.

Under each of the above headings the different mines are described, commencing with that of Silver Islet, in which, though operations are now suspended, the yield of silver was immense, and the venture proved the most extensive and successful of all yet undertaken in the district alluded to. The total value of silver produced from the commencement to the close of operations at Silver Islet is quoted at \$3,250,000. Numerous other islands where silver mines exist are also fully described, together with the works thereon. The coast section and Pie Island are reported upon, and the Port Arthur group next occupies attention. Under this

heading, we find Thunder Bay and Shuniah mines, together with a number of smaller mines or workings, and under Rabbit Mountain heading the rich Rabbit Mountain and the Beaver mines come in for a full description. The latter is especially rich, for Mr. Ingall quotes the statement of an Algoma paper, where it is stated "the total value of the products of the Beaver mine for the past two and a half months is \$93,000. This may be relied on as authentic." Mr. Ingall goes on to say there is every reason to believe this to be correct, as the Port Arthur Customs entries show \$190,000 worth of ore exported during 1887, the greater part of which certainly came from this mine. In the Silver Mountain group attention is called to the native silver occurring at Silver Mountain mine in leaves, sheets and nuggets weighing often several ounces, but litigation, which too often seems to be the fate of mining companies when rich veins are struck, has put a stop to work for the present. The Whitefish Lake group exhibit numerous veins, but very little mining has been done there. Mr. Ingall in summing up the whole area says that where it has been prospected the work has not been thoroughly carried on, and the question of the capabilities of the veins as ore producers is still unsettled, a remark which also applies to many of the mines opened years ago and closed altogether. There is, however, evidence of the widespread occurrence of rich silver ores throughout the whole formation of the district, and the existence of very numerous veins, on many of which, if properly handled, successful mines may be opened up. Experience has taught that more extended underground developments are required to prove their value, and unless this is acted upon with a sufficient of the capital at the start the failures of the past will be repeated in the future. Irregularities in width of veins in some cases dishearten operators, who are led thereby to believe that their vein had "pinched out," but pluck and energy in following it will generally carry the miner through the disturbed parts to where the vein will again be rich and solid. This has been proved by actual experience. The formation of the enclosing rock and physical characteristics of the surrounding formation tend to produce here and there fractures, and the dips of veins have in most cases not been sufficiently worked out to form a basis for classification.

From Port Arthur as a centre, the shore portions of all the district above described can be easily reached by small craft or steam tugs, while the C. P. R., the Dawson Road, and boat and canoe routes over the lakes and rivers, give means of communication with the inland portions. This district must figure largely in the production of silver in the years to come, and to those interested in the locality we cannot remember any Report which will throw more or better light on it than this by Mr. Ingall. He has done his work well and faithfully.

Annual Report of the Minister of Mines for British Columbia, 1888.

The above volume, just received, differs somewhat from ordinary Government blue books, being a series of reports from the various Gold Commissioners and Government agents of the province, each of which contains its own details and no regular synopsis or summary, if we except the tables showing the yield of gold, as given in the Minister's report itself. From the latter tables we gather the fact that there was decrease in the yield of gold during the past year to the value of \$76,978. This is shown to be attributable to various causes, in some cases as at Cassiar, the mines being gradually worked out, without new discoveries, and in other cases from lack of business principles in conducting operations. In this connection Mr. Sutton, government assayer at Victoria, very wisely remarks that very many of the misfortunes attending mining ventures in the province are brought about from a too eager desire to turn the yield into bullion, mills and machinery being provided *before* the existence of a sufficient quantity of paying ore has been definitely ascertained. This, he says, ought to be patent to anyone who has followed the history of mining in British Columbia. "Why run the danger of having a mill on your hands with no grist to grind?" Mr. Sutton's report contains a valuable list of the economic minerals found in the province, giving their localities, and he expresses the hope that this "will answer as a commencement towards a systematic arrangement of definite information" on this subject. Such a synopsis has long been wanted, and we hope to see Mr. Sutton continue it yearly with annual additional remarks. Speaking of the mineral characteristics of the province, he goes on to say: "It is somewhat premature to lay down any rules or observations," owing to want of development, and he complains that the samples sent from different points for assay are invariably too small to give satisfactory returns: "Pet samples" are misleading, and calculated to destroy confidence; samples for assay should not be less than one pound in weight.

Slate of an excellent quality has been discovered near Golden, and close to the C. P. R. track. Slabs of any desired size can be taken out, for billiard tables, mantles, flagging, &c., and it is pronounced to be adapted for roofing purposes. This discovery may be of great value. Platinum yielded in 1888 1,500 ounces. The only locality in British Columbia where it is obtained in sufficient quantities to render it worthy of mention is at Nicola.

The inference to be drawn from the various reports from each mining district may be summed up as follows:—Cariboo, successful; Keithly, falling off; Cassiar, yield decreasing; Kootenay, great promise, but requiring development; West Kootenay, far ahead for silver, of all other districts, both in quantity and quality; Jilloet, a shrinkage in yield;

ale, great promise, and mining companies showing unusual amount of energy.

There has been a marked increase in the output of coal last year, it being 75,940 tons over that of 1887. The report states that the increased demand and the satisfactory price which it has realized in the market have greatly enhanced the prosperity of the coal industry of Nanaimo, Wellington and Comox, where upwards of 10,000 men are constantly working in and about the mines, who with their families and homes of their own are to all appearance contented, prosperous and permanent settlers. The exports of coal were chiefly to ports in California, and smaller cargoes went to other Pacific ports, whilst British and American ships-of-war, ocean mail steamers and other vessels have also drawn supplies from the province. Extensive works in connection with the coal mines have been carried on in the Comox district last year, and a railway has been constructed from the mines to a shipping terminus, at Union Bay, where commodious wharves have been built. This has involved the expenditure of a large amount of capital, for which good returns this year are anticipated. British Columbia affords every evidence of being the coaling station of the Pacific in the future. Detailed returns of the various collieries are given at the end of the report. The various Commissioners and Government agents afford very valuable information respecting the districts they supervise, and it is at once apparent that their examinations are not by any means superficial or unreliable.

Electricity as a Mining Power.

At a recent inaugural address in England, before the north of England Institute of Mining and Mechanical Engineers, delivered by Mr. J. Marley, upon "Improvements in Mining," it was stated that the tendency of mechanical invention is decidedly to "elaborate other means of steam raising at the expense of coal," and economy in the consumption of the latter was strongly urged. The transmission of power is a subject now attracting great attention both on this continent and in the old world, and compressed air, hydraulics and electricity respectively have their claims advanced by their own advocates. Electricity seems to us the most likely means for adoption in the near future. In England already several mining companies have undertaken the application of electricity to the operation of mining machinery, and in the United States this power is largely used. The best means of convincing the incredulous is to cite some instances for them, and we can only choose from those to be met with in England and America. In the St. John Colliery at Normantown, the electrical transmission of power has been installed to work a pumping engine at the bottom of a shaft. A volume of water of 23,000 litres (100 litres = 22 gallons) per hour furnished by a subterranean sheet of water has to be raised to a height of about 270 metres (1 metre = 3.2808

feet). The pumps have been calculated for 32,000 litres per hour, and they have delivered regularly during the month of February last, 562,500 litres per day. The generating dynamo furnishes a current of 600 volts to the boundary, with an average of 66 amperes. The electromotive force at the boundary of the receiver is 575 volts. The result in water raised is about 33-horse power, and it follows therefore that the electrical transmission utilizes at least 50 per cent. of the power furnished by the steam motor. Compared with compressed air, electricity permits the realization of an economy of 25 per cent. on the expenses of first establishment, without counting the facilities of placing, inspection and maintenance presented by electrical motors. In the United States the installation is being prepared in Arizona for transmitting a force of 150 horse power to a distance of eight miles, between a waterfall and a mine. In Comstock the electrical transmission of power is to be applied to the workshops of New Nevada, where there are twenty crushing mills. In the Consolidated Virginia and California works there is a question of replacing by electricity the transmissions by metallic cables, which have caused very great disappointment. At Silver City some Sprague dynamos have been set up for a works of fifty crushing mills at a distance of four miles from a waterfall. These facts of recent date prove that the electrical transmission of force is making progress, and that opportunities are not wanting for it to be used. But its application in other ways, such as in driving vessels and the working of cranes, is indirect assistance to its extended employment in the mining industry. Pumping, winding, lighting, and accessory mechanisms are capable of good service from this source, and the miner who restricts himself to the employment of antiquated plant will find himself behind in the current of daily advance if he adheres to his old methods.

An Example of Bravery.—One of the most unexampled cases of bravery occurred at Hammond Colliery, near Girardville, recently. As an illustration of the devotion of one workman to another it was unexcelled. Thomas Hobin and Patrick Dougherty, two young men, were working together. A large piece of coal blocked the chute leading from one of the breasts to the gangway. This chute had a pitch of 75°, which is very near perpendicular. The block of coal was 18 feet from the gangway, and a plank was placed in position. Up this Hobin crawled, and after drilling a hole in the coal inserted a piece of dualin to which was attached a fuse. He lit the fuse and turned to descend. As he did so a rock fell from overhead and crushed the life out of him. Dougherty heard his death cry, but thought that he was merely caught, not killed. He could see the fuse burning, and knew that if the blast went off his friend would be blown to pieces by the flying fragments. In an instant he was up the steep plank, and snatched the burning fuse just in the nick of time. He was successful, but the cruel rock had crushed the life out of poor Hobin. There is a movement on foot to present him with some token. Mine Inspector Stein paid him a high compliment at the coroner's inquest.—*Colliery Engineer.*



In General.

Messrs. Couper, McCarnie & Co., the well known London firm of brokers and shippers, have dissolved partnership. The firm will hereafter be known as Couper, Miller & Co. The new partner is Mr. C. C. Hoyer Miller, one of the directors of the Canadian Phosphate Company.

B. L. Nowell, against whom six bills of indictment were laid for obtaining money under alleged false pretences and which were thrown out by the grand jury, has taken out an action for \$20,000 damages against James D. Macfarlane, who had preferred the charges.

The Canadian Superphosphate Company has been incorporated. The Hon. M. C. Cochrane, Wm. Abbott and Charles Colby, M.P., are provisional directors of the concern. The capital stock is placed at \$1,000,000.

Sales.

Sales of Canadian phosphates have recently been made in London at 9d. for 70 cent., 10d. for 75 per cent., while there have been enquiries for 60 and 65 per cent., which have not hitherto been asked for in England.

Du Lievre.

Navigation was resumed on the river on the 12th instant. Capt. Bothwell reports this to be the earliest opening within his recollection. The C. P. R. branch from Buckingham reopened upon the same day.

The transportation of ore will commence this week. The various stocks awaiting shipment and the preparations for handling them promise a busy season, but the difficulty of the passage at the Little Rapids, increased by the unfinished construction of the long desired locks, is realised by the shippers. The first scow of up freight for the mines has paid the penalty of the experimental trip by capsizing her contents, and scoring a heavy loss to the High Rock mines.

Acting upon the suggestion thrown out in our last issue, a deputation of mine owners, mine superintendents and managers, and others interested in the phosphate industry, waited upon Sir Hector Langevin at the House of Commons on the 24th instant. The party comprised Alonzo Wright, M.P., W. J. Poupore, M.P.P., W. W. Pickford, High Rock mines, J. Lainson-Wills, Canadian Phosphate Co., W. A. Allan, Little Rapids mines, A. Cameron and Capt. Bothwell, Buckingham, and B. T. A. Bell, editor of the REVIEW. Alonzo Wright, M. P., introduced the deputation, and Messrs. Wills, Poupore, Allan and Pickford urged upon the Minister the absolute necessity of the provision of a steam winch on float, or some other mechanical appliance, for the purpose of hauling craft up the channel at the Little Rapids, and it was pointed out that unless this was done without delay the various mines would be put to a very great inconvenience, and the transportation of phosphates and supplies would be very seriously interfered with. Sir Hector promised that the matter would be attended to, and referred the party to Mr. H. F. Perley, C.E., Chief Engineer of the

Department of Public Works, to whom he very graciously gave a letter of introduction explaining the urgency of the case. Mr. Perley, who was next seen, said he fully realized the importance of the matter, and led the party to understand that it would have his immediate and prompt attention. There is, therefore, every prospect that this obstruction to our local industry will be obviated at an early date.

Just as we go to press we learn that the Minister of Public Works has acceded to the request of the miners, and has given instructions to have the steam winch and float provided at the Little Rapids. This prompt recognition of the wants of the industry will give entire satisfaction to all concerned.

Mr. E. D. Ingall, M.E., and Mr. James White, of the Geological Survey, will shortly resume their investigations and survey of the phosphate region. The elucidation of the nature and origin of these deposits as a guide where and how to seek them, and the preparation of a map of the area under study on such a scale as will permit the delineation of the details of the distribution and association of the different rocks, are the chief aim and objects of this important work. Of the 210 square miles to be comprised within the limits of this map, the lakes, rivers, roads, &c., over some 125 square miles have already been surveyed by Mr. White. It is hoped that the balance of the work will be completed this summer, and that the report and map will be ready for the public by this time next year.

The Dominion Phosphate Company have improved their means of haulage at their No. 2 pit by completing the inclined track from the bottom to grass. The current output has been maintained during the development work by attacking the No. 5 pit. Prof. Donald has just sampled the stocks of ore for the buyers, Messrs. Lomer & Rohr, and shipments will commence forthwith. The steamer *Kate* has been thoroughly overhauled for this work, and is now afloat.

The output from the No. 11 pit at High Rock has shown a falling off during this month, but an improvement in their No. 5 is very encouraging. A new pier at the river landing is near completion, and preparations are made for discharging the scows by means of a steam hoister at Buckingham Village.

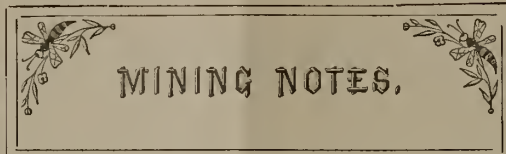
We have noticed a nice pile of ore from the Central Lake mines ready for shipping into scows at Chalifour's Landing. The exploratory work at these mines is evidently giving every satisfaction. Mr. Powers has uncovered some very fine shows which will afford good summer work.

The reports from the Canadian Phosphate Company's mines are satisfactory, the output being steady, and although the "Big Pit" at Star Hill shows a falling off, the last opened works are giving good results. The newly constructed scows have been successfully launched, and the wire tramway to river has resumed its activity.

The first down shipment of ore to the village has been made by the Ottawa Phosphate Mining Company from the Emerald mine.

Perth District.

Cap^t. R. C. Adams, managing director of the Anglo-Canadian Phosphate Company, has been called to England on company's business. The pits at Bobb's and Otty Lake are looking well, and are yielding a fair output.



We shall be greatly obliged to mine owners and superintendents for such authentic reports of their operations as may concern shareholders and the public.

NOTICE.

At the Annual Meeting of the Gold Miners' Association of Nova Scotia, held at Halifax, on 6th March, a resolution was passed adopting the "Canadian Mining Review" as the official organ of this Association. Our readers may therefore rely upon the accuracy of all information published in these columns bearing on the gold mining industry of the Province.

Nova Scotia.

Darr's Hill District.

It is understood that a suit has been instituted by Chas. F. Mott, of Halifax, to set aside the sale of the Dufferin mine, made at public auction on the 14th March. The yield of the mine for March was 156 ounces.

Killag.

Last autumn Mr. Geo. W. Stuart and associates took out some quartz from a 4 inch lode on the edge of the big swamp. Five tons of this were recently crushed, and yielded 10 oz. 11 dwt. 10 grs., or over \$40 per ton. A steam plant of 15 h.p. is being placed upon the swamp shaft, and will be used to work pumping and hoisting gear. As soon as this gear is completed sinking will begin, and the work prosecuted all summer.

Stormont District.

The Palgrave Mining Company obtained 170 ounces of gold last month from about 270 tons of quartz. The lode keeps its size, and is maintaining its average yield. The prospects for the future look well.

South Uniacke.

The Witherow-Hartlin property owners are enlarging their mill by the addition of five new stamps, supplied by I. H. Matheson & Co., of New Glasgow. The original plant was supplied by the Windsor Foundry Company.

Renfrew District.

The new mill of the Empress Company dropped its stamps for the first time on the 3rd instant. Latest advices say the mill is running very smoothly, and is crushing at the rate of three tons per head per diem, which is the best performance yet on record in this province.

Oldham District.

The Oldham Gold Company is doing nothing but pumping water. The Standard Gold Company are pushing work, and their property never looked better. The yield for March was about \$5,900. The east shaft and main shaft are both sinking, and the 350-foot level is in good ore.

Mahone Bay.

Mr. John A. Anderson and associates have a force of men prospecting on Blockhouse Hill. Good drift has been found, but no lodes have yet been cut.

Miscellaneous.

The first concern to manufacture pig iron in Canada will probably be the New York and Nova Scotia Iron and Railway Company, which proposes to erect two furnaces at New Glasgow, N.S., one for Bessemer and one for foundry pig iron, one of which will have a capacity of 25,000 tons per annum, employing several hundred men in mining the required 50,000 tons of ore, 50,000 tons of coal and 25,000 tons of limestone. Tunnelling will be commenced this month to analyze and ascertain the extent of the deposit, but the outcrop gives good indications. A staff of ten engineers has been surveying railroad routes from the mines to New Glasgow and the Intercolonial Railway since December, and the citizens have offered 100 acres within the town limits to any company working the mines. Bessemer pig iron is made from non-phosphoric ore, of which there are several veins along the East River.

At the last meeting of the Gold Mining Association, held on the 9th instant, Mr. George J. Partington was elected secretary-treasurer, in place of Mr. Townsend.

Prospecting work will be commenced in the American Gold Company's area next month.

The first decision in the co-partnership suit of Putnam v. Hardman & Taylor, which has been going on in the Supreme Court for two years, was given on the 20th April, and was substantially a verdict for the plaintiff. The case will be appealed.

On the East River of Pictou, 342 tons were mined by the Messrs. Grant and shipped via Hopewell to the Londonderry furnaces. This is a limonite of good quality.

The fall in the price of manganese ore lessened the production of the mineral last year at Tenny Cape and Onslow; but as the value has risen it is expected that during this season business will be brisker at these points.

The returns of the shipment of antimony ore mined by Mr. Macnaughton at Rawdon are given as 308 tons of No. 1.

Official returns to the mines office show that 41,619 tons of ore were mined by the Londonderry Iron Co. last year, and that 164 men were employed about the mine above and below ground.

Mr. R. E. Chambers with a small force, took out 1,000 tons from his limonite deposit at Brookfield. The vein was cross-cut and proved to be 18 to 20 foot wide. The ore hitherto extracted, has been smelted at Londonderry. It is of excellent quality and very accessible, being within two and a half miles of the railway.

New Brunswick.

The Victoria Mining Company are applying for letters of incorporation. The capital is \$10,000, the offices in Andover, and the applicants as follows: John E. Stewart, contractor, Andover; F. P. Thompson, manufacturer, Fredericton; Daniel McQueen, contractor, Woodstock; J. W. Hoyt, claim agent, Blissville; Whitfield Giberson, lumberman, Aroostook; James Stewart, contractor, Andover; Chas. H. Lugin, barrister, Fredericton. The provisional directors are: John E. Stewart, F. P. Thompson, Daniel McQueen, J. W. Hoyt, and Whitfield Giberson.

Quebec.

The revenue derived by the province from the sale of mining lands for the year ended 30th June last was \$5,225.55. The fees on permits, etc., granted to parties interested in mining amounted to \$839.00, and the expenses to \$20.78. The Commissioner of Crown Lands states that it is evident that future results will be of much greater importance. A complete reconstruction of the present Mining Act is promised. This, everyone will admit, is urgently needed, and if the new laws are only modelled on lines similar to those of the sister provinces of Nova Scotia and British Columbia there can be little doubt that an impetus hitherto unknown will be given to the mining industry of the province, and the present depleted state of the Treasury will be amply replenished.

During the last four years the Villeneuve mica mines have supplied the trade with about 35,000 lbs. of mica, representing an annual output of 9,000. There has also been taken out a crystal weighing 281 lbs., which yielded about \$500 worth of merchantable mica. At present the pure white felspar is being successfully used in the manufacture of pottery.

Preparations for a brisk season are being made at the New Rockland slate quarries. Slate of excellent quality is being won from a bench at a depth of 200 feet. It is expected that the output this year will be much more satisfactory than that of 1888.

The output of asbestos last year from Mr. W. H. Jeffrey's mine at Danville was in the vicinity of 207 tons. A blast on the 23rd inst. yielded 1,133 lbs. The daily output at present is 500 lbs.

Mr. Selater, of Fenwick & Selater, informs us that the actual output from the Megantic asbestos mine was 125 tons, as follows: *First* 30 tons, *Seconds* 50 tons, *Thirds* 45 tons. An average number of ten men were employed.

We understand that the Ward Ross asbestos mine at Thetford is at present on the English market, and is likely very soon to change hands. The property, owing to the limited means of the present owners, has only been worked on a very moderate scale. The pit at present shows an exceedingly good quality of asbestos and gives indication that if properly worked with ample capital it would prove a fair investment for any one taking hold of it.

The gold industry of the Chaudiere district has been prosecuted more vigorously lately than in former years. The four companies at present working are the Horace Sewell Co. on the Des Plantes, McArthur, and Coupal at St. Francis, Capt. Richard's on the Cumberland, and the St. Onge Bros. on the Famine.

The Shaft at the Des Plantes works is down to a depth of 30 feet, is about 60 feet east of the stream and half a mile north of the bridge near the mouth. Dr. Ellis, in his recent report states that coarse gold in good paying quantities is taken from this spot. The head of the river at one time yielded a large quantity of coarse gold.

The most extensive workings in the district are now carried on at the Ruisseau Meul, a branch of the Millbrook near St. Francis village.

A tunnel has been driven into the hill to a distance of 600 feet, in an old channel which at 400 feet was 30 feet below the adjoining bed of the brook from which it was separated by slate reefs. The gravel of the old channel has yielded considerable coarse gold, nuggets from \$5 to \$15 value having been taken out during the past season. Drifting near the upper end of the tunnel is now being carried on, but much difficulty is experienced from quicksand. Neither here nor at the Des Plantes are there any appliances suitable for saving fine gold, and some changes in this respect will be necessary before satisfactory results will be obtained. From 12 to 14 men were employed during the past season.

The work done by Capt. Richards on the Cumberland has been very largely of an exploratory nature and no returns of gold taken out are to hand. Difficulty from quicksand is experienced here in sinking shafts.

The St. Onge Bros. have driven in the east bank about a mile above the road across the mouth of the Famine, for several hundred feet in what they claim to be an old channel of that stream, and gold has been taken out in small quantities.

From the prospectus of the White's Asbestos Company (Limited), recently formed in London, we glean the following particulars regarding the new concern:—The capital is £100,000, divided into 100,000 shares of £1 each. The directors are John A. Hamilton (Messrs. Alston, Hamilton & Co.), 21 Mincing Lane, London, chairman; Major Henry Creagh, 29 Gwendor Road, West Kensington, London; T. B. Forward (late of Forward Bros. & Co.), Hawkshead House, Hatfield, Herts; J. Pellat Rickman (Messrs. Apsley, Pellat & Co.), 17 St. Bride street, London; and Alfred H. White, Quebec. The property conveyed consists of lots 5 and 6, 1st range South Garthby, 67 acres; lot 16, 3rd range South Garthby, 100 acres; lot 7, 6th range Coleraine, 105 acres; and lot 9, 10th range Coleraine, 100 acres; in all 379 acres. Lucius J. Boyd, Quebec, is the engineer of the company.

Justice Stirling has granted a petition before the High Court, England, to wind up the Canadian Asbestos and Antimony Company, on the ground that the vendors never acquired a title to the estates sold to the company.

The Glasgow Canadian Asbestos Company are making preparations for a resumption of work at their mines. An excellent quality of the mineral is now being produced.

Our last issue contained a reference to the Scottish Canadian Asbestos Company. We desire it to be understood that no reflection against the management of Mr. John J. Penhale, the able superintendent of the mine at present, was intended.

We are informed that the Excelsior Copper Company has decided to erect smelters at Harvey Hill, and a great quantity of ore will not be raised until these works have been erected. Col. Drew Gay, superintendent of the mines, is at present in England on the company's business.

Major Short, of Quebec, has commenced to open up an asbestos property in which he has an interest in range 9, Coleraine.

The American Asbestos Company is the title of a new private company shortly to be registered in England, and formed by the Wertheims to operate their property in Coleraine. The shares will not be offered to the public for some time, and are not to be quoted on the market. Mr. Louis Wertheim is chairman of the board, and Mr. Edward Wertheim managing director. At a recent meeting it was decided to put in an extensive plant to enable the production of a larger output. Prior to the sale of this property in November last some 60 tons were raised by Dr. Reed, and since it has changed hands a similar quantity has been quarried by a small gang during the winter. The present output is about 30 bags, or 1½ tons per day, but this will be very largely increased as soon as the machinery has been got into working order. Dwelling houses for the accommodation of a strong working force are in course of construction.

An engineer who has just returned from a visit to the Graphite plumbago mines speaks very highly of the new plant and the many improvements which have recently been made to the buildings there. By the way, we hear that the Hon. Mr. Chapleau, when on the continent, succeeded in floating a company to work the concern, but at time of writing we have been unable to ascertain the truth of the statement.

Ontario.

No new oil wells of value were bored in the province last year. The entire production in 1887 was 594,273 barrels, produced from about 2,700 wells, in the county of Lambton. The average depth of the oil rock in this county is estimated to be from 490 to 500 feet from the surface.

The oil well at Comber, Essex county, is 1,300 feet deep and is said to yield about one barrel of oil per diem.

The recent discovery of natural gas in the county of Essex has led to the proposal to form the Canadian Natural Gas Company limited. The incorporators are: N. A. Coste, of the township of Malden; Hiram Walker, Edward Walker, Franklin Walker, James Walker and Chandler Walker, of Walkerville; John Atkinson, of Detroit; John G. Haggart, of Ottawa, Postmaster-General of Canada, and others. The chief place of business is to be at Walkerville, and the total number of shares 25 at \$500 each.

A short time ago Mr. Chas. Moore sold a quarter interest in the Sultana gold mine, Lake of the Woods district, to Messrs. Galt & Bros., of Winnipeg. Recently Dr. Scovil sold a quarter interest to Mr. Hartt, coal merchant, Montreal, for \$2,750.

Sudbury District.

We understand that Dr. R. Beil, Assistant Director of the Geological Survey, will read a paper at the next meeting of the Royal Society upon "The Copper deposits of the Sudbury district."

We have received a copy of the prospectus of the Sudbury Mining Company recently incorporated. The capital stock is stated at \$100,000 in 10,000 shares of \$10 each, payable 25% on allotment, 25% in thirty days, and balance on call after notice of not less than thirty days. The directors of the concern are: Joseph Cozens, Saulte Ste. Marie, president; Robert McClain, Toronto, vice-president; Geo.

Dunstan, Toronto, sec. treas.; Alex. Mackie, Toronto; Lt.-Col. George A. Shaw, Toronto; Thos. E. Johnson, San Jose, Cal. The property proposed to be worked is known as the north half of lot 6, con. 3, township of Denison, consisting of 160 acres. The property is said to contain copper and gold quartz in paying quantities.

The Canada Copper Company's smelting works continue to produce large quantities of matte; 154 tons were given in twenty-four hours lately.

Port Arthur District.

The arrival of the first steamer from Duluth has created quite a stir in mining circles. Americans are evidently keen to get a good hold of the silver and iron finds, and several of the moneyed men are keeping parties of explorers in the Silver Mountain and Arrow Lake region all summer. Applications have also been made for extensive iron lands, in view of the almost certain take off of the American import duty on that article, the necessity for which is daily becoming more apparent.

The lead deposits in Black Bay are also receiving considerable attention.

The Badger, Beaver, Elgin, and Silver Mountain West mines are continuing their steady, uniform, satisfactory progress. The Silver Mountain East is, however, coming to the front again in a very marked manner, the ore from the west shaft being of the exceedingly rich kind which was first encountered in this mine.

The Wolverine mine has been working with such encouraging results that the adjacent "Queen" mining property has started to work again with renewed vigor; supplies, &c., are being teamed over the roads to Whitefish Lake, in spite of the great cost incurred at this season of the year.

The placing of a steamer on Whitefish Lake by the Silver Fox Company is a move which is duly appreciated by property holders in that region. It is not unlikely before the season closes that another will be placed on Arrow Lake also.

The matter of the railroad to the silver mines is the absorbing topic, but unfortunately great delay has occurred from a want of harmonious action of those concerned.

Several gold properties at the Lake of the Woods have recently changed hands, in view of the probable erection of a smelter, which has received a handsome bonus.

It is officially stated that the year's expenses of the Badger, including expenditure for land, mining and improvements are less than \$50,000. From September to February the shipments included three car loads of smelting rock, valued at \$24,000, \$40,000 and \$75,000 respectively; two lots of bullion, 6,269 and 3,916 ounces, value \$9,900. This statement was sworn to before the United States Consular Agent at Port Arthur. Thus the total receipts were \$142,650; total expenditure, \$50,000; net profit, \$92,500.

Manitoba and North-West Territories.

The Lords of the Admiralty have granted an interview to Macleod Stewart, President of the Canada Anthracite Coal company, regarding the use of Banff coal for the Pacific squadron, in lieu of Welsh coal. The Admiralty is arranging to test the fitness of the coal. Mr. Stewart expects favourable results.

The revenue derived by the Department of the Interior from the sale of coal lands in 1888 was \$74,700, being an increase of \$67,050 over the previous year. The total area of coal lands sold up to date is 12,078½ acres, and the total amount received therefor, \$124,508.82.

By an Order-in-Council dated the 10th of February, 1888, the price of lands containing anthracite coal was raised from \$12.50 to \$20, the latter being the price of this class of lands prior to December, 1885. By an Order-in-Council dated the 11th of July, 1888, the regulations for the disposal of coal lands in the Province of Manitoba and the North West Territories were made to govern the disposal of Dominion coal lands in the Railway Belt in the Province of British Columbia.

Returns from the Dominion Lands Agents show that during the past year 29 entries were made for mining locations other than coal. The revenue for mining lands for the year was \$430.75, made up as follows: Fees for entry and registration of assignments, \$231.75, and \$199 in payment of a mining location in British Columbia. The total area of mining locations sold up to date is 1,080.86 acres, which realized \$5,406.50.

The chief output of coal has been at Lethbridge, by the North West Coal and Navigation Company, and has been probably double that of any preceding year. The widening of the gauge of their railway and a connection with the American railway system at Fort Assiniboine would probably lead to a quadruplication of their output. Both of these enterprises will probably be accomplished this year. Within the past few weeks a Diamond drill has been added to the plant at these mines.

The output from the mines at Medicine Hat during 1888 has been meagre; legal complications have retarded operations. These, it is stated, have been adjusted, so that a renewal of operations may be anticipated. The Medicine Hat Railway and Coal Company assert that they will shortly build their railway and develop their coal properties.

The C. P. R. has during the past few months been developing some of its coal lands at Crowfoot Creek, at a point about four miles from the line of railway, so far with very favorable results. Tests are being made with the Diamond drill.

During the past season the original Bow River mine at Cochrane have been closed down; another has been opened with, it is stated, ample capital to back the enterprise, and coking furnaces are to be put into operation. As a coking coal it ranks "A 1," and the establishment of these furnaces should prevent a great deal of waste, which heretofore from its character had to be left at the pit mouth. With proper coking appliances it could be cheaply converted into coke, and a good market in connection with smelting works will no doubt be

obtainable in a year or two, as well as for fuel. The coming year will probably witness several diamond drill tests made in that neighborhood, which it is to be deplored was not made at the inception of mining in that locality.

British Columbia.

The new reduction works at Barkerville consist of a furnace building 75 feet long by 27 feet wide; a mill building 40 feet long by 22 feet wide; a pan room 30 feet long by 22 feet wide; and an engine room 40 feet long by 23 feet wide—all good, strong, substantial buildings. The contract price was \$4,700. The machinery consists of one Kendall stamp mill, capacity five tons in 24 hours; one twenty-horse power engine and boiler; one five-foot improved pan; one six-foot settler; the necessary shafts and pulleys for the above, and door frames, bolts and buckstays for a fifty-foot reverberatory roaster, which has a capacity of three tons of concentrated sulphurets in 24 hours.

The mining population of West Kootenay district numbers about 500 persons, and it is estimated that the capital invested figures about half a million dollars. The product for 1888 was about \$10,000 gold and \$75,000 silver. It is thought that these figures will be largely increased during the present year.

At Weaver Creek Mr. Leonard, a miner of great perseverance, who has stuck all alone to this creek for years, took out last summer about \$5,000 in coarse gold.

The Findlay Creek Mining Company has a first-class ditch and flume about 5¼ miles long and of a capacity of about 700 inches of water. The head at lower end is about 200 feet. The hydraulic plant consists of a 15-inch water pipe, No. 2 giant, and about 400 feet of 30-inch sluice, and has a capacity of about 1,000 cubic yards per day of 24 hours in ordinary gravel. The dead work, through clay and cement, is about finished, and a gravel bank of about 100 feet deep, which prospects well, has been all but reached. It is thought that the bed rock of one of the old channels coming in from the north will be struck in June or July, and that good pay will be the result. The company has erected good houses, a blacksmith shop, storehouses, &c., and has all the necessary tools and appliances to carry on the work; also a circular sawmill of average capacity. A prosperous season is expected this year.

The Perry Creek Gold Mining Company, owing to there being no waggon road to their mines and to the different pieces of metal being too heavy for pack animals, were unable last season to have the machinery for their large pump transported to its destination, and consequently the shaft, which, with much expense, skill and labor, had been sunk to bed rock last year, had to be temporarily abandoned, it being impossible to contend against the water without the aid of machinery. They have, however, during this year concentrated all their energies upon their mining ground known as the "Mount Cenis Tunnel," lower down the creek. This ground is supposed to be rich, but requires a large capital to thoroughly test it. Substantial buildings have been erected, comprising dwelling and boarding house for employes, storehouse, and an office. A dump house has been fitted up, wherein everything, under the able management of their efficient foreman, Mr. Dow, an old Cariboo miner, has been placed in perfect order for the summer's work—stove, dump box,

water heads and gates, and hydraulic air pipes for the tunnel being in place and order. The length of the tunnel, which gives evidence of first class work all through, is now about 580 feet. This tunnel is run at a higher level than the old one, and for the most part goes immediately over it. Pay was not expected till bed rock was reached and the canon through which the old channel originally ran was passed. By latest accounts bed rock had been struck, and although quite smooth, being not yet past the canon, a condition which generally prevents it from retaining the gold upon its surface, a very fair return from the last week's work (only one shift employed) was produced, about \$515 being taken out of the dump box. The company are now sanguine as to the success of their enterprise, to which, in the opinion of all, they are fairly entitled, considering the amount of capital they have invested and the courageous perseverance they have evinced under many difficulties.

The Star Mining Company (Yale district) have shown unusual energy in developing their mine by sinking a shaft 100 feet in depth, at the mouth of which a horse whim and blacksmith shop have been erected. The ledge is 4 feet in width, with a pay streak of about 20 inches. The assays range from \$20 to \$600 per ton.

The Planet mine, which is also the property of this company, is being developed in a businesslike manner. A shaft 40 feet in depth has been sunk, and at the bottom a level has been driven in a northerly direction which exposes a magnificent body of ore which has assayed an average of about \$95 to the ton. The owners of these mines were engaged during the summer in drifting, taking out rock for milling purposes, and shipping concentrates. The rock was hard quartz, showing galena, iron sulphurets and gray copper. The copper did not run over 4 or 5 per cent. The result of several assays of picked specimens, of which the following are two:—576 oz. silver and 2½ oz. of gold per ton; 407 oz. silver and 1½ oz. of gold per ton. The nearest point of shipment is Kamloops, to which place it costs about \$10 per ton to haul. The plant of the Star Mining Company is very complete, but not large enough to be profitable. It consists of a rock breaker and a quartz mill and two Triumph concentrators. The last named have done their work well, but the quartz mill is not a success, owing to the hardness of the rock.

A few days ago the Perry Creek Mining Company struck a rich pocket which yielded in the last wash-up \$1,327.50. A letter from the mine says: The place where we have struck the good pay is a deep hole, the dirt in which was literally full of gold, as it could be seen while handling it in the tunnel. There is a considerable quantity of it still in sight, and we expect still greater things in our next wash-up. The total clean up for January and February was \$3,200.

The Government Immigration Agent at Victoria states that the Belgian colliers who arrived at the mines last year are doing fairly well. Not knowing any English when they commence work in the pits is a great drawback to their immediate usefulness. After this objection is more or less removed by contact with English-speaking miners, their future, with sobriety and industry, is assured. Colliery managers report favorably of their work, care and economy in the use of explosives being one of their charac-

teristics. Three or four of these people lost their lives by the disastrous explosion in No. 5 pit, Wellington, nearly a year ago, but with this exception no other casualty has occurred among them. The opening up of the Comox coal field under the same management as the Wellington collieries will ensure employment for all the Belgian miners and those of other nationalities that are likely to come during the ensuing year.

Phosphates and Agriculture.

(Liverpool Journal of Commerce.)

Every matter connected with the cropping of the lands of any country is embraced in one formula—it is matter reconstructed. In nature's laboratory change is continually taking place; that which existed yesterday exists to-day, but in another form. The growth of a plant or an animal is but matter reconstructed; it may be natural, or nature may be helped by the wisdom and knowledge of man. The growth of plants is reconstruction of matter, which must exist, and be available at a given place—in the position in which it is required—in order that the plant may take it up. The chief constituents which a plant requires are nitrogen, phosphates and potash. In all soils these exist in some proportion. Nitrification is continually going on in every soil, and when the sun shines the nitrification is especially great. Active nitrates are the dearest of all our manures, simply because they are essential in their action on the other constituents of the soil, and because also they are evanescent, for being once in the soil, unless they are taken up at the moment by the plants, they may be washed away by the first shower of rain. They cannot be stored. Phosphates are not continually being formed in the soil, and the limit of its fertility is the amount of this necessary mineral existing in it. Phosphates are brought within the range of plant food by means of the active nitrates in the soil, and one of the great evils of the excessive use of nitrogenous manures, which has been common in English farming for many years, has been that the soils have become exhausted of their phosphates, and to a certain extent of their potash. Nature does not reproduce these, and once they are gone they have to be supplied by the hand of man.

British agriculture is what it is at the present day simply because we have exploited the whole world in our hunt for phosphatic manures. "England," once wrote the late Baron Leibig, who himself was the greatest agricultural reformer the century had seen, "is robbing all other countries of the conditions of their fertility." We have not even spared the graveyards of the gallant soldiers who have fought the battles of the world. But our manure manufacturers are finding that to these even there is a limit, and in December last the manager of probably the greatest existing manufactory uttered the plaintive cry that the phosphatic deposits were getting exhausted, while, at the same time, America is discovering the fact that her soils are becoming unfruitful in consequence of the exhaustion of the natural phosphates. Such excellent deposits as those in the valley of the Somme in Europe and the guano beds of South America, are showing signs of exhaustion and new sources of supply are absolutely essential if our soils are to "go the pace," and produce the large crops which they have for the last 20 years. This new source of supply is already on the eve of development. It is curious that they have not been developed before to day. The wonderful deposits of apatite in the valleys of

the Ottawa River, in Canada, have a richness in phosphate superior to those in any other part of the world. Apple green in colour and as pretty to the eye as any of the precious stones, they yield from 88 to 92 per cent. of tribasic phosphate of lime. The American Government, in the report of the geological survey, places these as the best in the world, and far superior to the phosphatic rock in Carolina, and declares that the future of American agriculture depends upon its development for their development.

The Treatment of Ores.

MILL MACHINERY.

Crushers—The ore, as received from a mine, is usually in large pieces, requiring a preliminary breaking before the succeeding finer crushing. This operation is performed by jaw-crushers, mostly some modification of the well-known Blake rock breaker. This machine is too well known to need description, and is the most desirable form of crusher for stamp mills. The Dodge crusher differs from the Blake chiefly in the fact of the oscillating jaw being pivoted below instead of above; and from this it results that the product is more uniform in size, as the discharge opening remains nearly constant. Where comparatively fine crushing is needed, as for instance, in sampling works or in preparing ore—for rolls—the Dodge is preferable to the Blake. The Comet crusher is an improvement on the Blake as far as capacity is concerned; the motion being rotary, every portion of the stroke is effective. For smelting works and concentration mills, when large crushing capacity is required at one point, the Comet crusher is the most effective yet introduced, being capable of breaking 40 to 50 tons per hour of hard rock.

Stamps.—In gold and silver mills, and some fine concentration works, stamps are used for the final crushing of the ore. Though a simple form of machine there is much greater difference in the results of differently constructed stamps than inexperienced men would anticipate. The form of mortar and cans, the material entering into stems, shoes and dies, and the placing of camshaft and guides, all exert influences of greater or less importance; and experience is alone the safe guide in such matters. It is a common expression that stamps are "crude and clumsy and wasteful," but this opinion is held most firmly by men of little real experience with good mills. For the actual work of crushing, with a clear discharge as in wet mills, the stamp can be scientifically defended as an effective form of the application of power; while in actual practice it has held its own against all competitors for economy and effectiveness. For dry crushing the stamp is not so easy to defend, its capacity being less than in wet crushing, and the matter of dust requiring great experience and care to prevent proving a nuisance.

Still, for fine crushing, on many ores, the dry stamp has not yet been superseded, in spite of the numberless death warrants pronounced against it by inventors of new pulverizers. In some cases fast-running rolls may be preferable to stamps with the limitation mentioned below, under the head of rolls. The great advantages of stamps are as follows:—They are simple to keep in order; easy of repair by an ordinary blacksmith; generally understood; susceptible of almost constant running; capable of being stopped, a few at a time, for repairs, so not delaying a whole mill; the wearing parts are simple castings; when once erected they

will last for years; they are, practically, economical; and when they are put up it is known positively in advance that they will do their work without any risk of failure or delay in starting. For mining purposes these advantages are so great that mining men must be credited with common sense in their continued preference for stamps.

Rolls.—The ordinary cornish rolls constitute an effective, simple and cheap machine for crushing rock after a rock-breaker, either wet or dry. Rolls are mostly used where the crushing is not to be carried very far, as in coarse concentration mills and sampling works. Of late years they have been improved in form of construction and driven at a much higher speed than formerly, and now have their strong advocates as superior to dry stamps, for even fine crushing. For this purpose the shells must be of good material, kept true in surface, and fed regularly and evenly across their full width. In a few cases, crushing to pass a screen of 20 to 30 mesh, rolls have actually been used with great success. There are, however, ores which are clayey in character, on which the success of rolls for fine crushing, is still very doubtful; and sufficient evidence is not available to settle the question of their applicability to crushing any ore finer than 30 mesh. Millmen differ much among themselves as to the need of fine crushing for roasting silver ores, but the general tendency in gold and silver mills at the present day is towards a coarser crushing than formerly employed.

For leaching mills, the use of rolls offers several obvious advantages over that of dry stamps. The limit of the coarseness of crushing is determined here simply by the results obtained in roasting, and the reduced proportion of fine dust produced by rolls greatly facilitates the subsequent leaching process. In amalgamation mills the employment of settlers limits the coarseness of the crushing.

Pulverizers.—During the last 20 years a great number of new pulverizing machines have been invented, brought to public notice, put in limited operation, and, after failure, allowed to drop out of sight. New machines still keep coming out, most of them embodying some fatal weakness which has already ruined previous machines equally promising in their time. The greater part of these machines depend either on the attrition of the rock particles between surfaces of the machine or the crushing of the ore under rapidly running balls or rolls. The weakness in these forms of machines is either in the excessive wear of the grinding surfaces (for no metal can be economically employed as a purely grinding surface on hard rock) or in the wear of the driving portion in roll or ball machines. The use of attrition surfaces will condemn any new machine, however constructed. The most successful roll pulverizer is the Huntington mill, which introduces the novelty of an oiled bearing for the crushing rolls, and a suspension of the same from above, so that the whole wear is on the crushing surfaces, as the rolls run round against a horizontal steel tire. Any advantage there may be in a fast running roll or ball is here obtained with the minimum of power and wear, owing to the use of oiled bearings and a horizontal travel. A vertical revolution is obviously inferior to a horizontal one, because the motion is, in part, against gravity, and, as a consequence, an uneven force is exercised and uneven wear induced, while power is lost.

Huntington Mill.—This is used only for wet crushing, and has been by far the most successful competitor against stamps which has yet appeared. It has in its construction avoided the

fatal defects of previous pulverizers, and represents most nearly a combination of fast running rolls with the mortar and screening advantages of the stamp mill. It has been largely used in California, and its most obvious advantage consists in decreased cost of transportation, from small weight compared with stamps, the practical absence of heavy expenses in erection, and decreased power required to run it. These advantages have made the mill very favorably considered for preliminary work on a mine where distance is great or capital limited. It is the only mill which, for mining purposes, has a record of continuous work on a large scale, and with successful results.

Sturtevant Mill.—This mill has been used in smelting works where very large capacities are required. The machine consists of two cylindrical heads revolving in opposite directions within a screen-lined casing. The heads become filled with a conical lining of the material to be crushed, and these rock faces throw, by centrifugal force, the pieces of ore which fall on them, against the pieces thrown in an opposite direction by the other head. In this way the rock is made to break itself. To prove that this is no theory of the action of the machine, it is possible to feed into it when in motion balls of hardest white cast iron which rapidly smash themselves to pieces without injury to the machine. This mill has been used successfully on some materials to crush as fine as 40 and 50 mesh, by using outside a revolving screen and returning to the mill with the coarse ore, the part not yet fine enough to pass the screen. As a preparatory machine, combining the work of rock-breaker and coarse rolls in one operation, the enormous capacity of this mill offers great advantages. Its wearing parts consist simply of short cast iron cylinders easily replaced.

Another Dobson.

A little over three years ago a Mr. George Henderson, who gave out that he was a mining expert, arrived in this city from Portland, and registered at the Driard. He became acquainted with a number of gentlemen interested in mining matters, and through the combined efforts of himself and an associate a bonus of \$5,000 was placed in the estimates of the session of 1886 for the erection of a smelter. It was proposed to place this at Esquimalt. For some reason or other this project fell through, but Henderson had become acquainted with men of means, and his plausible manner of conversing on mining subjects secured to him their confidence. In the spring of 1886 he heard of a mine on the Fraser, near Big Slide, about 20 miles west of Clinton. He visited it and returned with some of the ore, and spoke in glowing terms of the mine. It was just what he had been looking for, and he could guarantee an immense success if a company was formed for its development. A company was formed, composed of the leading capitalists of Victoria, and a number of miners were imported for the purpose of opening the property up. The results of assays and mill tests of the ore were in favor of Mr. Henderson's theories, and the prospects were bright for the Foster Gold Milling and Mining Company (Limited). Stock was liberally subscribed. A crushing and roasting plant was purchased at San Francisco by Mr. Henderson, who up to the present point had declined to accept salary, thereby increasing his confidence with the

directors. He spoke of the wonderfully rich returns which would be received when the mill was in working order, and the stockholders looked forward with pleasant anticipation to the golden bars that would soon be forwarded to Victoria from the mine. Matters went along swimmingly; roads were built, the works placed in position, and after the supreme moment had been postponed from time to time the crushers and roasters and concentrators began their work. Some difficulty was experienced in working the machinery, but at last Mr. Henderson arrived in Victoria with a piece of flat yellow metal which he said was gold and the product of the mines. He still glowingly danted upon the big yield that was sure to come, and prophesied that shares would advance a thousand per cent. However, he took good care to sell several thousands of dollars worth of the shares allotted to him. Every possible effort was made to successfully work the machinery, but at last it was given out as a failure, and the company closed down the works, after the voluble George had succeeded in getting rid of about \$75,000 of the stockholders' money.

The ore discovered in Nicola then attracted his attention, and George went in and bonded a couple of ledges. He was never known to work himself, his time being occupied in blowing, living on the fat of the land, playing cards and billiards, and smoking fragrant Havanas. He spent the money he had gained through the sale of the shares, and was about "broke" when he applied to several gentlemen formerly interested in the Foster. Surprising to relate, he secured advances, and his first report from the Star mine was to the effect that he had purchased a team of horses and was about to build a house. This was strictly against instructions, and George was compelled to relinquish cash received and the agreement of partnership, and this "deal" was killed.

But his cheek and loquacity were not lost, and he induced other gentlemen to go in with him, and thus secured funds to proceed with work. He sunk a shaft and developed a body of good ore. Then he purchased a small crushing and concentrating plant and a diminutive steam engine, and by dint of making others work hard—he was never guilty of anything of that sort himself—he at last succeeded in getting a car load of concentrates together, which he shipped to San Francisco, and they returned \$40 or \$50 per ton, or about one-fifth of their cost. He returned to Victoria, remained for a few days, and again departed for San Francisco. He has not been seen since. Altogether he managed to run up about \$15,000 debts for his too-confiding associates, Nicola ranchers and others, who would like to see him once more.

During his work in Nicola he brought up quartz miners from Grass Valley, Cal., and failed to pay them a dollar, although he had thousands of borrowed money in his possession, and they and their families were forced to borrow money to return to where work could be secured. Altogether, from a business point of view, Mr. Henderson has made a very bad reputation for himself, and should he ever revisit Victoria the people he has duped and robbed will have the satisfaction of placing him where he belongs—in the meshes of the law.—*B. C. Colonist.*

The North American Chemical and Mining Co. have made application to the Federal Government for a rebate on machinery imported from England for the manufacture of Portland cement.

Canadian Mining Companies in England

	Price Per Share.
General Mining, Limited £219,752 fully-paid shares of £8 4½ 5	
Plant, Barrasois and Lingan, \$309,100 fully-paid shares of \$100.....	—
Data, \$200,000 vendors fully-paid shares of \$100.....	—
N. Western Coal and Navigation, Limited, £160,500 6 per cent. debentures; coupons June 30 and Dec. 31; paid 13½ 1 1	—
Data, £14,500 fully-paid ordinary shares of £10.....	—
Data, £14,500 fully-paid deferred shares of £100.....	—
Sydney and Louthsburg Coal and Railway, Limited, £500,000 cumulative 10 per cent. first preference shares of £10.....	7 9
Data, £14,500 fully-paid non-cumulative 6 per cent. second pref. of £10.....	3 5
Data, £250,000 fully-paid ordinary shares of £10.....	1 2
Vancouver Coal Mining and Land, Limited, £66,850 fully-paid shares of £10.....	6½ 7½
Data, £11,150 shares of £10, £9 paid.....	—
Excelsior Copper, Limited, fully-paid shares of £1.....	—
Data, shares of £1, 17s. 6d. paid.....	—
Shuniah Weachu, Limited, £39,888 fully-paid shares of £1.....	—
Silver Wolverine, Ltd., £68,465 fully-paid shares of £1.....	—
Anglo-Canadian Asbestos, Limited, £39,132 fully-paid shares of £2.....	—
A. Canadian Phosphate, Limited, £46,340 fully-paid pref. shares of £1.....	—
Data, £1,000 fully-paid deferred shares of £10.....	—
British Columbia Smelting, Ltd., £25,000 preference shares of £1, 18s. 11d. paid.....	—
Data, £1,000 fully-paid ordinary shares of £1.....	—
Canadian Asbestos and Antimony Company, Limited, £160,000 fully called shares of £5.....	—
Canadian Phosphate, Ltd., £1,000,000 fully paid shares of £1.....	3½ 1

General Mining.—Accounts to December 31 submitted in April, but an interim meeting is held in November. Dividend for 1884, 5 per cent; for 1885 and 1886, 1½ per cent each year; and for 1887, £4 13s. 6d. per cent. Reserve fund, £2,000.

Louthsburg.—The vendors' shares, up to the end of 1888, do not rank for dividend until 7 per cent. per annum dividends have been paid on ordinary shares. Accounts to Dec. 31. For 1887, 5 per cent. was paid on the ordinary shares other than those held by the General Mining Association, the Company foregoing their dividend rights.

North-Western Coal.—The deferred shares receive on dividend 15 per cent. per annum (cumulative) has been paid on the ordinary shares. Accounts to June 30. Dividend for 1887-8, 5 per cent.

Sydney and Louthsburg Coal.—Accounts to Dec. 31 submitted in May. Out of the profits of 1884 one half-year's dividend on the first preference shares was paid. No dividend since. Debit to Dec. 31, 1887, £1,174.

Vancouver Coal.—Accounts to June 30 and December 31 submitted in November and May. In the half-year to June, 1888, there was a net profit of nearly £11,000. Debentures, £57,200. Reconstruction has been decided on.

Excelsior Copper.—Registered September 26, 1888. Authorized capital, £47,000; purchase of consideration, £400,000, in cash or shares. Fully-paid shares issued to the vendor; partly paid to the vendor.

Shuniah Weachu.—Accounts to Nov. 20 submitted in February. No dividend yet.

Silver Wolverine.—Registered October 19, 1888, with a capital of £100,000, of which £50,000 was the first issue. Most of the shares were issued to the vendor.

Anglo-Canadian Asbestos.—The Company was registered in November, 1885. Accounts to October 31 submitted in March. No dividend yet. Debentures, £3,450. Reports are not obtainable, but this information is official.

Anglo-Canadian Phosphate.—The preference shares rank first for 7 per cent., and after a like rate has been paid on the deferred shares, both classes rank equally.

British Columbia Smelting.—The company was registered May 9, 1888. The ordinary shares were issued to the vendor, and they do not rank for dividend until the preference shares have received dividends amounting to 100 per cent.

Canadian Phosphate.—Accounts to November 30 submitted in February. Eleven months to Nov. 30, 1888, resulted in a profit of £1,576, which was carried forward.

Nickel Mining.—The nickel industry of the world is a most peculiar one. It has only been about sixty years since it first came into use as a mineral, though it has been known to Japan and the eastern nations for centuries. There are nickel mines in France, Germany and Wales, in Pennsylvania, Nevada and Oregon. Nickel is not, as is generally supposed, a mineral that is mined like silver, and then smelted and reduced from an ore. It is a chemical element which is extracted from arsenides, cobalt and sulphides. The yield from these substances, as found in France and Wales, is only about 2 per cent nickel, but the yield of some mines in Nevada not yet developed is fully 20 per cent. of pure nickel. About thirty years ago there was discovered in New Caledonia, a French penal colony, a wonderfully rich deposit of nickel. A French company was immediately formed, and this company to-day almost controls the trade in this country. It also almost controls the nickel trade of the world, and it has frequently declared its intention to ruin every other nickel manufacturer and run them perpetually out of the business.

The Late Canadian Asbestos and Antimony Company.

The following circular has been issued to the shareholders of the Canadian Asbestos and Antimony Company, Limited. It will be seen that the directors have decided to repudiate the purchase of the properties, and to return in full the amounts received from the shareholders:—

SIR,—I am instructed by the directors of this company to explain to you the delay which has occurred in communicating with you, and which has been unavoidable. From information which the directors received after the allotment of shares had been made, they thought it desirable to obtain, through the Dominion Government of Canada, an official report on the properties to be purchased.

By cablegram from the Government it appeared that the several properties were at the time inaccessible, owing to the ground being covered with snow, and that it would be impossible to report upon them without some delay. The directors thereupon applied to the vendors for an extension of time. This it was not within the power of the vendors to grant except on terms which would have necessitated the directors parting with the control of a large portion of the shareholders' money. Then followed communications between the directors and vendors, the result of which is that the company, acting under the advice of Sir Horace Davy, Q.C., and Mr. Alexander Young, has repudiated the purchase. The directors have resolved to personally defray all outgoings and expenses of the company, which represent in the aggregate a considerable sum, in order that the shareholders may receive back their subscriptions in full, and free from any deduction whatever.

The directors are advised that it is necessary that the company should first be formally wound up, for which proceeding the initiatory steps have been taken. Enclosed herewith is a form for your signature, which the directors will be pleased to receive from you duly signed by return of post. I am desired to express the regret of the directors that you should have had any trouble in this matter, and their hope that you will appreciate their action in protecting, as they have done, the interests which you had committed to their charge.

I am, sir, your obediently,

GEORGE WM. LAKEMAN,

Secretary.

St. George's House, Eastcheap, London, E.C., April 4th, 1889.

Remarkable Rock Drilling.—Several months ago, Mr. Edward Askew started work upon a contract for driving a tunnel at the Suffolk colliery, St. Nicholas, Pa. He reports having driven with two three-inch Allison rock-drilling machines, worked by air-compressors, during the month of January, one hundred and thirty-five and two-thirds feet through hard sandstone and rock, size of tunnel 8 by 12 feet. He claims this remarkable drilling to be unparalleled in history of rock-drilling or tunneling.

The Natural History of Coal.

(Contributed by Francis D. Taylor, M.F., Brockville.)

The subject which I have undertaken is one that is surrounded with considerable difficulty, and will require care on my part not to indulge in mere supposition and hypothesis. I shall purposely avoid the pursuit of many tempting fields of scientific enquiry that might legitimately be regarded as connected with this paper from a desire to make the subject as practical and useful as possible. My aim will not be to astonish or confound but to teach; not to puzzle, but to make plain. I shall therefore try and put into as clear and condensed a form as I can, these truths in connection with the subject of the present enquiry that the investigations of scientific and

practical men have made certain and satisfactory, leaving to others, whose powers of mind, and range of observation are greater than my own, the task of elucidating and developing many important and deeply interesting questions connected with the natural history of coal that are at present obscure and problematical.

I think it will help in the recollection of the subject if I place my observations under the following heads:

First—The geological formations with which coal is usually associated, with some remarks on their character and mode of deposition.

Second—The composition of coal and the circumstances under which it is found.

Third—The present position of coal, and the changes to which it has been subjected.

Fourth—Some general and miscellaneous remarks suggested by the subject, that cannot properly be arranged under either of the above heads.

(1.) Under the first head your attention must be called to the fact that the geological range in connection with the natural history of coal extends from the top of what is called the upper silurian strata to the base of the permian or new red period, a range which embraces the most important, the most wonderful, and the most interesting period of the past geological history of our planet.

Comparing the various rocks of which our earth is composed to the leaves of a book, there is no part of that book more interesting to the philosopher, more important to the student, and more valuable to us all, than the carboniferous range.

The rocks of which the earth is composed, from the ancient granites which form the loftiest mountain ranges of the world, and which often (as in the Himalayas of Asia, the Andes of South America and the Alps of Europe) send their peaks through the clouds, to the recent tertiary strata that form the plains of the North-West Territories of the Dominion of Canada, may be regarded as so many tablets on which the Great Architect of the Universe, has written with the finger of infinite wisdom, and almighty power, the history of the world; and evidently it is the design of the Great Creator that His intellectual creatures should investigate, read and learn the handwriting that is to be found upon the rocks for themselves. It is not merely the language of poetry, but of fact, that we have

"Sermons in stones, and good in everything."

In speaking of those rocks that form the base of the carboniferous or coal-bearing strata, it is well to remark that, while as a rule the mountain limestone usually forms the base, basin or trough in which the coal strata lies, in many parts of the world this great geological formation is absent, while in other cases, both the mountain limestones and the old red sandstones are absent, and we have the coal resting directly on the silurian rocks. This is the case in the marvellous coal field of South Staffordshire, England, and the investigations of Prof. Jukes in connection with this subject, have shown that, while the old red, and lower carbonaceous rocks of the rest of England were being deposited, there was a belt of country stretching from Shropshire, through South Staffordshire, and into Warwickshire that was dry land, and formed an island in that ancient sea.

By observations like these, important facts are arrived at, and the geological history of our earth is developed with as much certainty, and accuracy as the motions of the heavenly bodies, or the results of mathematical calculations.

In Scotland, on the other hand, the coal measures rest on the old red sandstone, the mountain limestone being absent, and this, together with several other facts, prove that the Scotch coal fields are of prior date to most of the English and Welsh coal fields.

The coal fields, including that of South Wales, Dean Forest, Gloucester and Somerset, have many geological features in common, and were evidently formed at the same time and under pretty similar circumstances. Each of these coal fields rests on a base of old red sandstone, a siliceous coarse red and brown conglomerate rock of immense thickness, in many cases from 8,000 to 10,000 feet in thickness.

This rock is peculiarly barren of fossils in this district, though rich in this respect in Scotland, and many other parts of the world, thus giving evidence of having been found in comparatively a shallow sea and during a very rough and stormy period of the world's history. The character of the fossils that have been found, the angular and breccian character of many of the beds that compose this formation, show that where the old red sandstone was formed, the earth was much shaken by volcanic action and the sea agitated by terrific storms. Upon the old red sandstone (in the southern coal fields) rests the carboniferous or mountain limestone, which is from 600 to 1,000 feet in thickness, consisting of dark shales, with immense bands of lime rock. This huge mass is full of organic remains of the most wonderful and beautiful character, and not the least striking and important feature in connection with this formation is the fact that in passing from the old red sandstone to the mountain limestone, a distance of only two or three feet, will suffice to carry you from a very barren strata in regard to fossils to a formation so rich in the evidences of organism and life as almost to baffle our powers of belief.

It is an interesting and important enquiry as to whether the absence of fossils in one strata, and their abundance in the other, is due entirely to the original absence of life; or the subsequent obliteration and destruction of the evidences of that life? Probably both causes have helped to produce this result, for the period of the formation of the old red sandstone was peculiarly unfavorable to the existence of life; and its chemical composition is also most unfavorable to the preservation of life.

(2.) As to "the composition of coal and the changes to which it has been subjected." The vegetable origin of coal has been for many years doubted and disputed, but the evidence on this point, has been so overwhelming and conclusive, that no one of any scientific knowledge now doubts the truth. Among the proofs that can be given of this fact are:

First—That coal contains the same chemical constituents as vegetable products.

Second—That the results of its decomposition and destruction is to produce the same elements.

Third—Coal can be traced through all its stages from vegetable fibre to peat, lignite, brown coal, jet, bituminous coal and anthracite—the different classes of substances chiefly differing in the proportions in which their elements are combined, and especially in the different proportions of carbon they contain.

Fourth—The remarkable traces of vegetable remains in coal, especially in the overlying shales, is proof positive that coal is of vegetable origin.

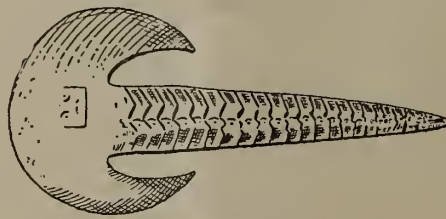
Assuming that this point is admitted without further argument, let us consider the way in which the great mass, or carboniferous, or coal-bearing strata, was deposited. This formation

of strata is, generally speaking, from 10,000 to 12,000 feet in thickness, taken from its base at the top of the "grit" to the surface of the carboniferous beds, which usually lie unconformable to the new red sandstone. This gives a total thickness of over two miles of coal-bearing strata.

The number of workable seams of coal in different sections of England and Wales (only including those above 2 feet in thickness) are between twenty and thirty in number, and the aggregate thickness of the whole is from 90 to 100 feet, or say 10 feet of coal to every 1,000 feet of carboniferous strata. In the southern coal field it is estimated that the entire thickness of the coal-bearing ground is about 6,000 feet, or a little over one mile in thickness, while in the centre of the Somersetshire coal field (Mr. Radstock) it is about 8,000 feet, or over $1\frac{1}{2}$ miles. There are 27 workable seams of coal at the northern end of this coal field, of an aggregate thickness of 61 feet.

The percentage of coal to coal strata in the Bristol and South Wales coal fields may be taken as nearly equal, the difference in the two fields being rather commercial than geological. In one case in South Wales the seams are fewer, but thicker, more regular, and for steam purposes superior in quality to those of the Bristol coal fields.

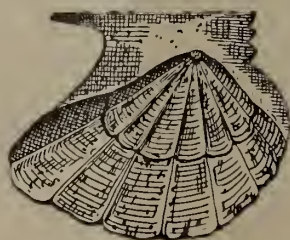
The question now is, how this mass of vegetable matter we call "coal" and the matrix or coal strata in which it lies embodied was deposited. For many years it was supposed that all strata in which coal is found was of fresh water origin; but this theory always appeared to contain many difficulties which could not be very well explained. For instance, take the great coal field of Central America, extending, as it does, over an area greater than the whole area of the British Isles, or about 150,000 square miles. The formation of this immense deposit would have required a lake six or seven times larger than the whole of the present vast American lakes united. Of course this is not impossible, but it appears to be highly improbable; and the discovery of marine fossils in the coal strata, has removed some very great difficulties out of the way of our present enquiry. In the northern coal fields there have been discovered in the shales overlying some of the coal seams, the remains of fishes and shells, such as the



Cephalopodous

fish (about $6\frac{1}{4}$ in. long), which is an extinct soft-bodied creature, with the organs of motion arranged round the head.

Then the *Avicula pecten* is another of the



Mollusca.

fauna found in the northern coal shales. They, too, are of marine origin, and are bivalves of the conchiferous order. This class includes that numerous family of mollusca that have shells for their protection like oysters.

Spirifer have also been found in the coal beds



Mollusca.

in Scotland, and as all these fossils are of marine species there is no resisting the conclusion that most, if not all, our coal strata fossils are either of marine or semi-marine origin.

At the same time the smooth, fine-grained and beautifully laminated shales of our coal formation show that its deposition was free from those violent agitations of sea action which marked the period of the old red sandstone. And, looking at all the evidence afforded, both by the fossiliferous and chemical character of our coal shales, it looks as if it were due to depositions placed in vast lakes or inland seas, which formed receptacles for land floods and river drainage, and at the same time were open to tidal action of the sea. This view removes a mass of difficulties that otherwise would stand in our path, and makes the question much clearer and freer from doubtful hypothesis.

Having arrived at the conclusion that coal is a vegetable formation and coal shales (or the matrix in which coal is found) are of marine or semi-marine origin, we are now in a position to enquire how the coal beds and the shales came into their present position and relationship, and in no way can the phenomena be accounted for but upon the following principles:

First—That each bed of coal once formed, the surface of the ground.

Second—That there was a gradual depression or alteration of level that gave an opportunity for the deposition of the intervening strata.

Third—This theory, of course, supposes that the depression or sinking of the strata was stayed periodically for a sufficient length of time to allow each coal bed to form.

And this, again, involves a fourth point, namely, that the process must have been slow and gradual, and the period required to form the whole immense.

To make the matter clear as to the process by which coal was formed, it is desirable to begin at the first or lowest bed of the series, and will again refer to the strata of 6,000 feet before mentioned. In the centre of this southern coal field the veins lie at a depth of 5,000 or 6,000 feet (or over one mile) below the level of the sea, and yet according to the theory propounded the present position of this bed of coal must have been once the surface of the ground and the site of a vegetable formation that baffles conception or description. And when it is understood that the thickest forest the world has ever seen would hardly suffice to produce a bed of coal 3 feet thick the wonder is increased.

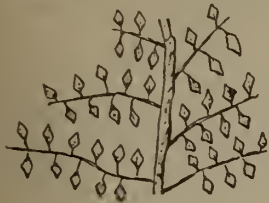
Further on reference will be made to some of the atmospheric and other conditions that probably assisted in the production of this marvelous flora, but for the present we will confine attention to the formation of coal rather than the peculiar circumstances under which it was formed and the flora of which it is composed.

The reader will please suppose a luxuriant, rank and peculiar tropical vegetation, covering the surface of the ground on which it grew in vast abundance and great variety—ferns (the largest number of species of which are now extinct), over 200 species of which have been discovered in the different coal fields in the world. Then judge of the vast preponderance of this

flora in the carboniferous era. The whole British Isles to day only produce about 50 species now of ferns.

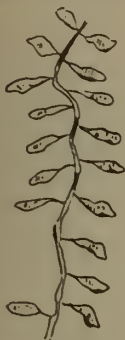
The most numerous family were the *Pecopteris*, or comb leaf fern, of which there are in the coal measures about 60 species.

Sphenopteris, or wedge-leaf fern, of which there



about 28 species. This plant has a wedge-shaped leaf.

Neuropteris, or nerve-leaf fern, of which there



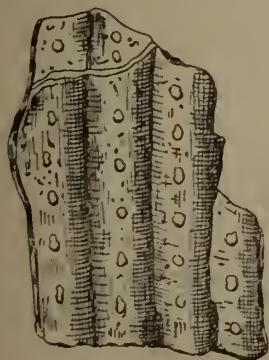
are about 25 species. The best illustration of this class of flora is to be found in Ceylon, the islands of the Pacific and the Indian Archipelago.

Calamites, a reed. These are very abundant



in the coal measures. They are reedlike in form. This family are now found from the extreme north to the equator, but they differ essentially from the fossil calamite, in the absence of a sheath that encircled the present trile at the joints. The calamite generally occurs leafless, and in the fossil state often reaches from 20 to 40 feet in height.

Sigilaria, a seal, so called from the seal-like impressions on its trunk; roots or trees grow from 20 feet to 70 feet high, and from 1 to 5 feet diameter.

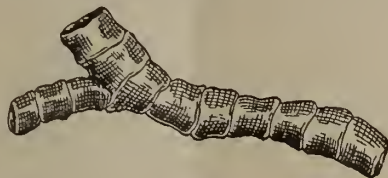


Stigmaria, roots of the *Sigilaria*.

The *Sigilaria* is a most important and abundant species. This plant was the most abundant and probably the most remarkable of the carboniferous period. About 60 species have been discovered. They had a conical stem; deeply

furrowed; not jointed with scars; each furrow arranged in vertical columns. The scars are supposed to be the point at which the leaves of the tree were connected with the stem. The height of these trees often reached 60 or 70 feet, and they have been discovered 7 or 8 feet in diameter at the base, and sometimes standing in an upright position. The plant called the *Stigmaria*, of which the underclay of nearly all coal seams is full, is now proved to be the root of this important plant. There are no living species with which we can identify the *Sigilaria*. Brongniart, the French naturalist, has, however, discovered, by a very careful examination of the tissues of the plant, that it belongs to a peculiar family of "coniferous trees," and was therefore of a high order of vegetation.

Lepidodendron, or scale tree, was another



abundant and large sized plant of the carboniferous age. These trees have been found in many places from 30 to 40 feet in length, and, notwithstanding their vast size, Brongniart has shown that this species belong to the *Lycopodium*, or club moss species of our own heaths.

Lycopodium—



Natural size.

But the largest species now known are in New Zealand, and there they only reach the height of 2 or 3 feet. There are about 40 species of this in the fossil flora. The stem looks scaly, hence the name, and may be easily distinguished. The trunks of this plant often con-



tain seed vessels called *Lepidostrophi*, and these seed vessels are found parallel to the tree.

The presence of coniferous trees, which are allied to pine more than the European firs (no sketch) prevents classing the coal flora as low in the scale of vegetable structure, the coniferous ranking high; thus proving that, while no doubt the great bulk of the flora of the carboniferous period was of a lower organism than the present, that there was also flora of a high order.

Try to conceive the growth of these vast preadamite forests, covering, as they did, the marshy, low, swamps of our globe, and that through these forests there crawled few reptiles, whose remains

have come down to us, with some few insects or other creatures.

Try to think of this dense, dark, untrodden, unexplored forest, growing for years and centuries, perhaps, to the wonder of the beings who inhabit other worlds, to whom, perhaps, the Almighty explained that in ages yet to come He was going to create a being to inhabit this world whose organism and wants would be different to theirs, and that one of his wants the mineral we call coal; and that these forests were to be covered up, so that in their decay and preservation this future want of the future inhabitants of our world might be supplied (this ought not to be regarded as fancy); and then think of vegetation being submerged and covered with a fine muddy deposit, which, when hardened, formed our coal shales.

Think of this, and you will understand how the formations of coal and the strata of coal in which it is embedded are formed.

And the vegetable formation having become sufficiently extensive and dense, a sinking of the country takes place, and over the vegetation which has been described the sea flows, and vast rivers and streams from the adjoining country pour in their waters, bearing in their course the detritus of the rocks over which they have passed. This deposit, with portions of the vegetable structure which it covered, formed the black, grey and white carbonaceous deposits called coal shales.

(To be continued.)

The Utility of Mica for Electrical Purposes.—Mica is used very largely in connection with electric plants. Its lightness and value as an insulating material has, especially for commutator use in dynamos, motors, &c., superseded all other materials. The color of the mineral, unless largely caused by iron association, does not affect its value for electrical uses.

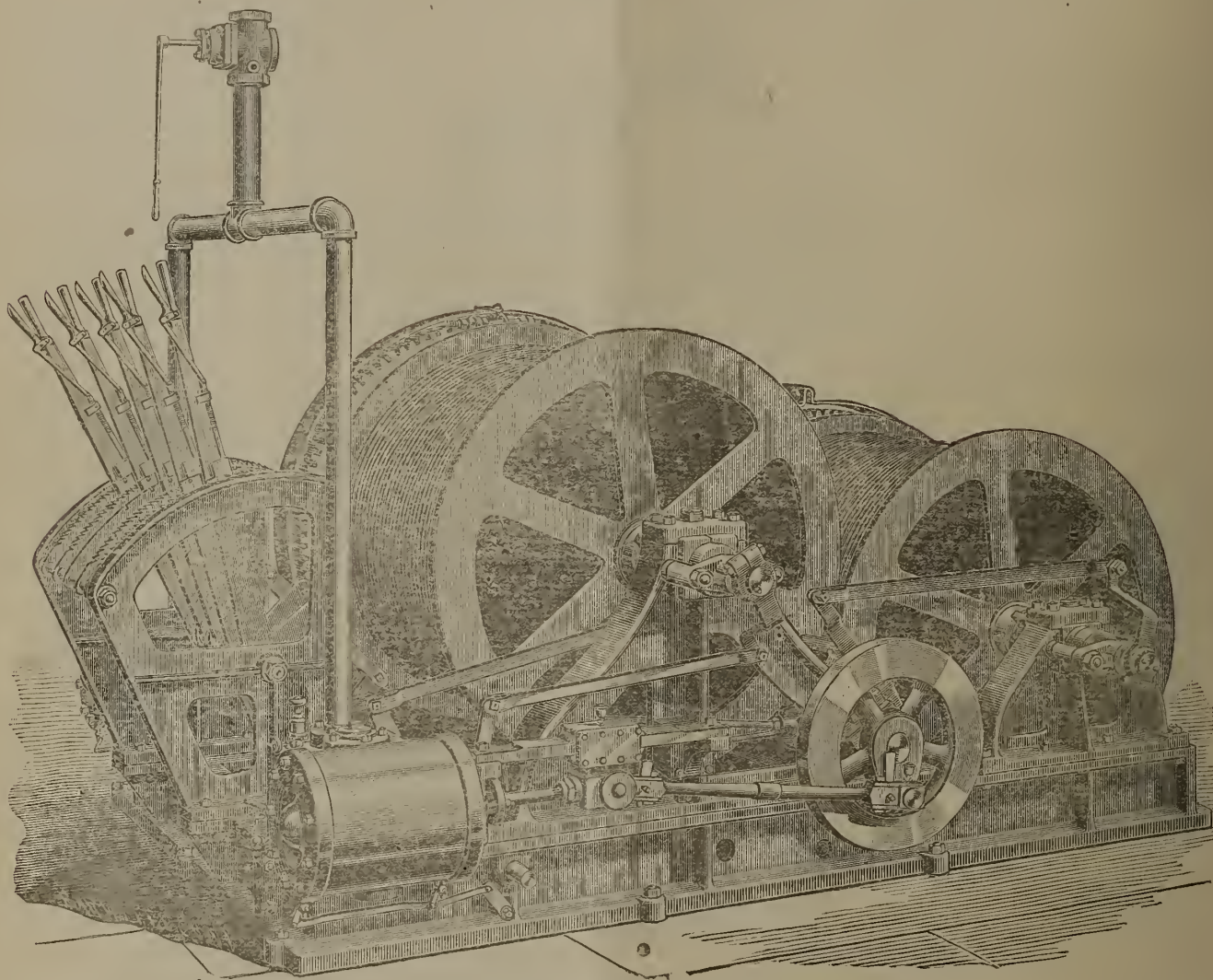
A Mechanical Slate Picker.—There are half a dozen devices patented, some of them being in successful operation, for separating the slate from the coal in our breakers. Of all inventions, the simplest yet planned is that recently exhibited as the joint contrivance of Mr. Thomas E. Phillips, superintendent of the Lehigh and Wilkes-Barre Coal Company, and John E. Evans, a miner of Wilkes-Barre. The apparatus is the perfection of simplicity. A common chute having a sheet-iron bottom, is placed beneath the screens, and into this the coal and slate fall. Four or five feet down the screen the bottom bulges up in a sort of ridge crosswise of the chute. The sliding pieces of coal and slate are slackened in their speed by this ridge. Just below the ridge there is a hole through the bottom of the chute, crosswise, and six or eight inches wide. Beyond this opening the bottom of the chute consists of a piece of sheet iron, which may be moved so as to leave the opening narrower or wider. This piece may also be raised or lowered. The sliding pieces of slate, being heavier and rougher than the coal, are slackened in their speed so that they drop through the opening. The coal being lighter and more glassy, slides so swiftly as to jump over the opening and continues on down the chute into the bunkers. The appliance is a wonder of effectiveness, simplicity and cheapness, its cost being little more than a plain chute. It is to be put into one of the large breakers for a test, and its operations will be watched by all the superintendents of the anthracite region, as they have great confidence in it.

Lidgerwood Improved Hoisting Engines.

One of the best known establishments especially devoted to the manufacture of hoisting machinery and boilers in the United States, is that of the Lidgerwood Manufacturing Company, 96 Liberty street, New York, N.Y. This firm manufacture a great variety of hoisting engines, with and without boilers, single and double, for mining, manufacturing and general hoisting purposes; also hoisting locomotives, improved pile-driving derricks and high-speed geared coal hoisting engines. By additions of special tools

engine is used largely, and is recommended for use in connection with the tail-rope system, double track inclines, or double compartment shafts. It is also especially well adapted for hoisting and conveying material by means of a suspended wire cable. Both drums are loose on the drum shafts, and entirely independent of each other in operation. They may be thrown in and out of gear with the engines in motion, either separately or together, or one drum may be lowering while the other is hoisting; or both drums may be thrown into gear, and the engine used as a regular reversible engine, one load being hoisted while the empty cage is being lowered. The obvious advantage of this style

versible link motion hoisting engine) made by this company in the position of the friction drums and the arrangement of the brake levers for handling same. The patent friction drums are of large diameter, and placed one ahead of the other. This arrangement of the drums admits of leading the ropes nearly straight to the head frame, and will be found suitable for those places where the former engine will not answer on account of its width. The drums are spirally grooved for wire rope, and simple, durable and effective. The reverse friction and brake levers are placed in front of the engine, arranged to work in a vertical position, and have the usual thumb-latches engaging with notched qua-



LIDGERWOOD IMPROVED HOISTING ENGINE FOR MINES.

and labor-saving appliances and improvements and alterations in designs they have increased the good quality of their machines, and now offer them as the standard, modern high-speed hoisting engines, both as regards high duty and economy, durability and simplicity, combined with ease and rapidity of operation. A type of hoisting engine manufactured by them, which is especially adapted for mining purposes, and which is meeting with great success throughout the mining regions of both North and South America, is shown in the engraving on this page, which represents their improved double-friction drum and brake, and reversible link motion hoisting engine for mining work. This

of engine for the tail-rope system is evident, for as one drum being thrown into gear winds up the main rope, the other drum being out of gear and loose on the shaft pays out the tail-rope, while by reversing the engine the tail-rope is wound up and the main rope paid out. This is done with the minimum of friction and wear on the engines. The same independence of drum action is also very desirable at times on inclined and mine shafts, under either of which condition the engines will work with perfect satisfaction. In general design the engine is solid and compact, and is intended for high speed and large hoisting duty. It differs from the original style (double friction drum, and brake, and re-

drants, so that they will stay in any position desired. This is a great convenience, and contributes materially to the easy and rapid handling of the machine. The brakes are of the band type, and are self-acting and very powerful, so that they simply have to be applied by the hand levers and do not require any great pressure. There are over 5,000 hoisting engines manufactured by the Lidgerwood Manufacturing Company in use, and all give perfect satisfaction.

The company have just issued a new catalogue, finely illustrated, describing their various styles of engines, which they will be pleased to send to those making application for same.

The Yukon Gold Region.—From the Report of the Minister of the Interior just published we learn that recent exploration has shown that this district has a much greater value than was previously supposed. It would seem that for gold the best paying streams so far as discovered are in Canadian territory. About 300 miners were in the country in the summer of 1887, but it is difficult to say what amount of gold they have taken out, as they are somewhat reticent on the subject. They all agree, however, that \$8 per day is poor pay, hardly enough to cover expenses. Taking this as an average, they cannot have made less than \$500 each, or \$150,000 altogether. Obtained with the crudest and most primitive appliances this result shows what may be expected so soon as communications with the interior become more easy, and the importation of improved mining machinery possible. Drift coal was found at various places, indicating the existence of seams further up.

SCIENTIFIC AMERICAN

ESTABLISHED 1845

Is the oldest and most popular scientific and mechanical paper published and has the largest circulation of any paper of its class in the world. Fully illustrated. Best class of Wood Engravings. Published weekly. Send for specimen copy. Price \$3 a year. Four months' trial, \$1. MUNN & CO., PUBLISHERS, 371 Broadway, N.Y.

ARCHITECTS & BUILDERS

Edition of Scientific American.

A great success. Each issue contains colored lithographic plates of country and city residences or public buildings. Numerous engravings and full plans and specifications for the use of such as contemplate building. Price \$2.50 a year, 25 cts. a copy. MUNN & CO., PUBLISHERS.

PATENTS

may be secured by applying to MUNN & CO., who have had over 40 years' experience and have made over 100,000 applications for American and Foreign patents. Send for Handbook. Correspondence strictly confidential.

TRADE MARKS.

In case your mark is not registered in the Patent Office, apply to MUNN & CO., and procure immediate protection. Send for Handbook.

COPYRIGHTS for books, charts, maps, etc., quickly procured. Address

MUNN & CO., Patent Solicitors,
GENERAL OFFICE: 301 BROADWAY, N. Y.



SEALED TENDERS addressed to the undersigned, and endorsed "Tender for Post Office, etc., Almonte, Ont.," will be received at this office until Wednesday, 24th April, 1887, for the several works required in the erection of Post Office, etc., Almonte, Ont.

Specifications can be seen at the Department of Public Works, Ottawa, and at the office of Mr. Andrew Bell, C.E., Almonte, on and after Wednesday, 10th April, 1889, and tenders will not be considered unless made on form supplied and signed with actual signatures of tenderers.

An accepted bank cheque payable to the order of the Minister of Public Works, equal to five per cent. of amount of tender, must accompany each tender. This cheque will be forfeited if the party declines the contract, or fail to complete the work contracted for, and will be returned in case of non-acceptance of tender.

The Department does not bind itself to accept the lowest or any tender.

By order,

A. GOBEIL,
Secretary.

Department of Public Works,
Ottawa, April 4th, 1889.



Notice to Contractors.

SEALED TENDERS addressed to the undersigned, and endorsed "Tender for Toronto Works," will be received at this office until Friday the 3rd day of May next inclusively, for works at the Eastern entrance to the harbour of Toronto, in accordance with the plans and specification to be seen on and after Friday, the 19th inst., at the office of the Resident Engineer, 25 Toronto Street, Toronto, and at the Department of Public Works, Ottawa.

Intending contractors are requested to bear in mind that tenders will not be considered unless made on the printed forms supplied and accompanied by a letter stating that the person or persons tendering have carefully examined the locality, have satisfied themselves as to the nature of the materials to be dredged, and the facilities which exist for procuring the materials required for crib-work, etc.

Tenders must be signed with the actual signatures of the tenderers.

An accepted bank cheque, not limited as to time of payment, for the sum of \$20,000, payable to the order of the Minister of Public Works, must accompany each tender. This cheque will be forfeited if the party declines to enter into a contract when called on to do so, or fail to complete the work contracted for, and will be returned in case of non-acceptance of tender.

The Department does not bind itself to accept the lowest or any tender.

By order,

A. GOBEIL,
Secretary.

Department of Public Works,
Ottawa, 15th April, 1889.



TENDERS.

SEALED TENDERS addressed to the undersigned, and endorsed "Tender for Indian Supplies," will be received at this office up to noon of

THURSDAY, 9th MAY, 1889,

for the delivery of Indian Supplies during the fiscal year ending 30th June, 1890, consisting of Flour, Bacon, Groceries, Ammunition, Twine, Oxen, Cows, Bulls, Agricultural Implements, Tools, &c., duty paid, at various points in Manitoba and the North-West Territories.

Forms of tender containing full particulars relative to the Supplies required, dates of delivery, &c., may be had by applying to the undersigned, or to the Indian Commissioner at Regina, or to the Indian Office, Winnipeg.

Parties may tender for each description of goods (or for any portion of each description of goods) separately or for all the goods called for in the Schedules, and the Department reserves to itself the right to reject the whole or any part of a tender.

Each tender must be accompanied by an accepted Cheque in favor of the Superintendent General of Indian Affairs on a Canadian Bank, for at least five per cent. of the amount of the Tender, which will be forfeited if the party tendering declines to enter into a contract based on such tender when called upon to do so, or if he fails to complete the work contracted for. If the tender be not accepted, the cheque will be returned.

Each tender must, in addition to the signature of the tenderer, be signed by two sureties acceptable to the Department for the proper performance of the contract.

The lowest or any tender not necessarily accepted.

This advertisement is not to be inserted by any newspaper without the authority of the Queen's Printer, and no claim for payment, by any newspaper not having had such authority will be admitted.

L. VANKOUGHNET,
Deputy Superintendent-General
of Indian Affairs.

Department of Indian Affairs,
Ottawa, April, 1889.

Diamonds, Jewelry, Watches & Silverware

AT ROSENTHAL'S

Goldsmith's Hall, 87 Sparks St.

OTTAWA.

INSOLVENT NOTICE.

In the matter of **BRADFORD L. NOWELL & Co.**, of the City of Montreal, Insolvents.

Lands and Phosphate of Lime Mining Rights in the Province of Ontario and Quebec for Sale by Authority of Justice.

I am instructed by the undersigned Curator to sell by Public Auction, within my Sale Rooms, No. 1747 Notre Dame St., on

Tuesday, the 28th day of May next,

At 11 o'clock in the forenoon,

All and singular those certain tracts or parcels of land and premises situate, lying and being in the Township of Loughborough, in the County of Frontenac, in the Province of Ontario, and more particularly described as follows, to wit:

Lot No. 1.

Ninety acres, more or less, of the North part of lot Number Six, in the Tenth Concession of the said Township, described as follows: commencing at the North-East angle of said lot, thence West the width of said lot or thirty chains, thence South along the side line thirty chains, thence East thirty chains, thence North thirty chains to the place of beginning. Together also, with all mines and quarries of metals and minerals, in or under the land upon that portion of said lot being West of the West Bay or Gold Lake, whether already discovered or not, with liberty of ingress, egress and regress for the purpose of removing the same only.

Lot No. 2.

All the Phosphate of Lime in and upon lot Number Ten, in the Eleventh Concession of the said Township of Loughborough, with full, free, irrevocable sale and exclusive license to mine and work all and every or any of the mines, veins and seams of Phosphate of Lime opened as well as unopened in, under or upon the said lot with out interruption, claim or disturbance from or by the Proprietor of said lot or any other person whomsoever, and to carry away and dispose of all such Phosphate of Lime as may be found therein, to and for their own use and benefit and for the purpose aforesaid to sink and make shafts, pits, levels, trenches, ways, gates and watercourses, and to erect and use any machinery, workmen's or other houses, and to use all lawful ways and means whatsoever for finding and removing the said Phosphate, and also to take and use sufficient groundroom, heaproom or pitroom, for placing the said Phosphate and for leaving the waste, refuse or rubbish to be from time to time produced from the said mines, and also with the full and free liberty to erect, construct or use any part of the said premises, or any roads or ways therein for any purposes connected with the said mines, and the removal, sale and delivery of the produce thereof, provided in so doing they do not injure the crops or other property on said lot.

Lot No. 3.

All the Phosphate of Lime and the full rights to mine the same in certain parcels or tracts of land situate, lying and being in the Township of Buckingham, in the County of Ottawa, in the Province of Quebec, comprising 200 acres more or less, and being west half of lot 21, and east half of lot 22, of the Eleventh Concession of the said Township of Buckingham. These rights are wholly undeveloped, no mines having as yet been opened on the property.

The lots will be sold separately, subject to existing mortgage and the reservations, limitations, provisions and conditions expressed in the original grant from the Crown.

Terms cash, or half cash, and the balance on approved security at three and six months.

All information can be had on application to the undersigned,

SAMUEL C. FATT,
Curator.

WILLIAM H. ARNTON,
Auctioneer.

FRASER BUILDINGS,
43 St. Sacrament St.,
Montreal, 25th March, 1889.



ASBESTOS Cloths, Packings, Furnace Cements, Paper, Stove Linings, &c.
SPECIALTIES: FIREFELT, a flexible Asbestos Sheet, made in tubular sections and rolls, best and most durable non-conductor made.
SUPERATOR, a strong fire & waterproof fabric for suitable sheathing & roofing buildings, fire proofing boiler rooms.
THE CHALMERS SPENCE CO.,
419 TO 525 EIGHTH ST., NEW YORK.

ASBESTOS.



Minning Regulations

TO GOVERN THE DISPOSAL OF

Mineral Lands other than Coal Lands, 1886.

THESE REGULATIONS shall be applicable to all Dominion Lands containing gold, silver, cinnabar, lead, tin, copper, petroleum, iron or other mineral deposits of economic value, with the exception of coal.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein, either by surface or subterranean prospecting for mineral deposits, with a view to obtaining under the Regulations a mining location for the same, but no mining location or mining claim shall be granted until the discovery of the vein, lode or deposit of mineral or metal within the limits of the location or claim.

QUARTZ MINING.

A location for mining, except for iron on veins, lodes or ledges of quartz or other rock in place, shall not exceed forty acres in area. Its length shall not be more than three times its breadth, and its surface boundary shall be four straight lines, the opposite sides of which shall be parallel, except where prior locations would prevent, in which case it may be of such a shape as may be approved of by the Superintendent of Mining.

Any person having discovered a mineral deposit may obtain a mining location therefor, in the manner set forth in the Regulations which provides for the character of the survey and the marks necessary to designate the location on the ground.

When the location has been marked conformably to the requirements of the Regulations, the claimant shall within sixty days thereafter, file with the local agent in the Dominion Land Office for the district in which the location is situated, a declaration or oath setting forth the circumstances of his discovery, and describing, as nearly as may be, the locality and dimensions of the claim marked out by him as aforesaid; and shall, along with such declaration, pay to the said agent an entry fee of FIVE DOLLARS. The agent's receipt for such fee will be the claimant's authority to enter into possession of the location applied for.

At any time before the expiration of FIVE years from the date of his obtaining the agent's receipt it shall be open to the claimant to purchase the location on filing with the local agent proof that he has expended not less than FIVE HUNDRED DOLLARS in actual mining operations on the same; but the claimant is required, before the expiration of each of the five years, to prove that he has performed not less than ONE HUNDRED DOLLARS' worth of labor during the year in the actual development of his claim, and at the same time obtain a renewal of his location receipt, for which he is required to pay a fee of FIVE DOLLARS.

The price to be paid for a mining location shall be at the rate of FIVE DOLLARS PER ACRE, cash, and the sum of FIFTY DOLLARS extra for the survey of the same.

No more than one mining location shall be granted to any individual claimant upon the same lode or vein.

IRON.

The Minister of the Interior may grant a location for the mining of iron, not exceeding 160 acres in area which shall be bounded by north and south and east and west lines astronomically, and its breadth shall equal its length. Provided that should any person making an application purporting to be for the purpose of

mining iron thus obtain, whether in good faith or fraudulently, possession of a valuable mineral deposit other than iron, his right in such deposit shall be restricted to the area prescribed by the Regulations for other minerals, and the rest of the location shall revert to the Crown for such disposition as the Minister may direct.

The regulations also provide for the manner in which land may be acquired for milling purposes, reduction works or other works incidental to mining operations.

Locations taken up prior to this date may, until the 1st of August, 1886, be re-marked and re-entered in conformity with the Regulations without payment of new fees, in cases where no existing interests would thereby be prejudicially affected.

PLACER MINING.

The Regulations laid down in respect to quartz mining shall be applicable to placer mining as far as they relate to entries, entry fees, assignments, marking of localities, agents' receipts, and generally where they can be applied.

The nature and size of placer mining claims are provided for in the Regulations, including bar, dry, bench, creek or hill diggings, and the RIGHTS AND DUTIES OF MINERS are fully set forth.

The Regulations apply also to

BED-ROCK FLUMES, DRAINAGE OF MINES AND DITCHES.

The GENERAL PROVISIONS of the Regulations include the interpretation of expressions used therein; how disputes shall be heard and adjudicated upon; under what circumstances miners shall be entitled to absent themselves from their locations or diggings, etc., etc.

THE SCHEDULE OF MINING REGULATIONS

Contains the forms to be observed in the drawing up of all documents such as:— "Application and affidavit of discoverer of quartz mine." "Receipt for fee paid by applicant for mining location." "Receipt for fee on extension of time for purchase of a mining location." "Patent of a mining location." "Certificate of the assignment of a mining location." "Application for grant for placer mining and affidavit of applicant." "Grant for placer mining." "Certificate of the assignment of a placer mining claim." "Grant to a bed rock flume company." "Grant for drainage." "Grant of right to divert water and construct ditches."

Since the publication, in 1884, of the Mining Regulations to govern the disposal of Dominion Mineral Lands the same have been carefully and thoroughly revised with a view to ensure ample protection to the public interests, and at the same time to encourage the prospector and miner in order that the mineral resources may be made valuable by development.

COPIES OF THE REGULATIONS MAY BE OBTAINED UPON APPLICATION TO THE DEPARTMENT OF THE INTERIOR.

A. M. BURGESS,

Deputy Minister of the Interior.

SEND FOR SAMPLES AND PRICES FOR

Asbestos Bags, Phosphate Bags, Ore Bags, &c.,

SPECIAL SIZES MADE TO ORDER.

DOUBLE SEWN.

DICK, RIDOUT & CO.,

PROPRIETORS TORONTO BAG WORKS,

Office and Warehouse: 11-13 Front St. East. Factory: 14, 16, 18, 20, 22 Bay St.

TORONTO.

ESTABLISHED 1878.

SHIPMAN ENGINES, ACME MODEL. COAL OIL FOR FUEL.



To parties requiring a safe, reliable, durable and economical Steam Launch, from 20x4 to 35x7 with ample power to give satisfactory speed, we can supply the best on the market and at prices which will defy competition for a like quality of goods. We have a full staff of competent boat and engine builders and guarantee every article to be strictly first class. Hundreds of our engines from 1 to 12 h. p. Marine or Stationary have been in use for years and are acknowledged superior to all others. No smoke, dirt or sparks, no manual or mechanical labor necessary. You have the privacy of your launch for your family. As the water and oil supply is automatic very little attention is required. But a few minutes is necessary to get up 100 lbs. of steam; when you return to the boat house by turning a hand wheel all fire is extinguished. Orders for coming season should be placed at once, as the demand is much in excess of previous years. Write for 1889 circulars giving prices, testimonials, etc. No attention paid to postal cards.

JOHN GILLIES & CO., Carleton Place, Ont.

By Royal



Letters Patent.

The Perfection Smoke Consumer & Fuel Economizer.

FOR ALL HORIZONTAL BOILERS, STATIONARY AND MARINE.

At City Waterworks (Wheelhouse), C.P.R. Works and Canadian Rubber Co., Montreal

Users of Lancashire, Cornish, and other flued boilers, invited to correspond.

Improved method of setting for new and existing boilers.

Dobson & Brodie, - - 169 St. James St.,

MONTREAL.



JOHN A. ROEBLING'S SONS CO.
WIRE ROPE

—FOR—

Mines, Elevators, Inclines, &c.

GALVANIZED GUY ROPE. BRIDGE CABLES.
HAWSER ROPES.

WIRE of all kinds. Insulated WIRES

John A. Roebling's Sons Co.

117 & 119 LIBERTY St., NEW YORK.

H. L SHIPPY Sec'y.

VALUABLE PLUMBAGO

AND OTHER

Mineral Lands FOR SALE,

IN THE TOWNSHIP OF BUCK-
INGHAM, COUNTY OF
OTTAWA.

1st.—Lot 28, in the 6th range, containing 100 acres, in addition to the salina of the lake.

2nd.—North half of lot 23, in the 5th range, containing 100 acres.

3rd.—Nine acres of lot No. 28, in the 5th range, with water privileges thereto appertaining, being site of mill dam, etc., etc.

The property formerly belonged to the Montreal Plumbago Mining Company, and was worked successfully for several years, until the company's mill was destroyed by fire, but the mill dam remains almost uninjured, and there are on the property several houses, sheds, etc., built for various purposes when mining operations were carried out.

The Plumbago Deposits

upon the property are regarded as amongst the richest and most extensive in the Dominion. As to the quality of the Plumbago, it has been extensively used in the manufacture of crucibles, lubricating leads, stove polish, etc., etc., and given unbounded satisfaction. This is established by the experience of consumers, and by a certificate from the celebrated Battersea Crucible Works, London, England, a copy of which is open for inspection.

MICA

has also been discovered in quantity

The lands are in the Phosphate region, and recent prospecting has disclosed a rich and extensive deposit of this mineral. There are unrivalled facilities for transporting the ore to and from the mines by the Ottawa River and C. P. Railway. Distance from mines to Railway Station 6 miles. Good road.

All that is required to make these valuable mines handsomely remunerative is a little capital and enterprise.

The Title is Indisputable.

For information apply to

WM. H. DICKSON,
160 Waller St., Ottawa.

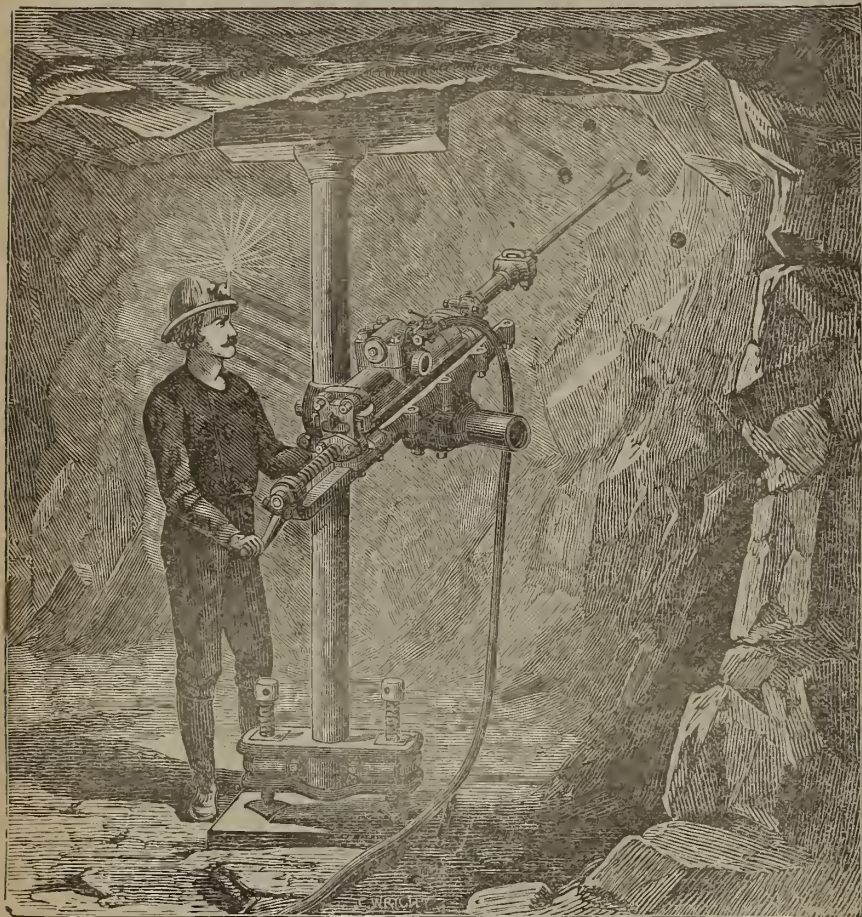
H. E. DICKSON,
Russell House, Ottawa.

OR TO THE OFFICE OF

THE CANADIAN MINING REVIEW
OTTAWA.

F. G. BECKETT ENGINE CO.

HAMILTON, ONT.



Having had many years practical experience in the manufacture of

MINING MACHINERY

IS NOW PREPARED TO CONTRACT FOR

Stamp Mill Machinery,
Concentration Mills,
Revolving, Roasting and
Drying Furnaces.
Rock Breakers,
Cornish Rolls for crushing,
Amalgamating Pans and Settlers,
Concentrators and
Revolving Screens,
Smelting Furnaces, Retorts,

HOISTING ENGINES,

EITHER GEARED OR DIRECT ACTION.

Cornish Pumping Machinery,
Iron Ore Cars, Safety Cages, &c.,
Rock Drills and Air Compressors.

STEAM ENGINES AND BOILERS.

Marine Engines and Steam Yachts.



DEPARTMENT OF Inland Revenue.

AN ACT RESPECTING AGRICULTURAL FERTILIZERS.

The public is hereby notified that the provisions of the Act respecting AGRICULTURAL FERTILIZERS came into force on the 1st of January, 1886 and that all Fertilizers sold thereafter require to be sold subject to the conditions and restrictions therein contained—the main features of which are as follows:

The expression "fertilizer" means and includes all fertilizers which are sold at more than TEN DOLLARS per ton, and which contains ammonia, or its equivalent of nitrogen, or phosphoric acid.

Every manufacturer or importer of fertilizers for sale, shall, in the course of the month of January in each year, and before offering the same fertilizer for sale, transmit to the Minister of Inland Revenue, carriage paid, a sealed glass jar, containing at least two pounds of the fertilizer manufactured or imported by him, with the certificate of analysis of the same, together with an affidavit setting forth that each jar contains a fair average sample of the fertilizer manufactured or imported by him; and such sample shall be preserved by the

Minister of Inland Revenue for the purpose of comparison with any sample of fertilizer which is obtained in the course of the twelve months then next ensuing from such manufacturer or importer, or collected under the provisions of the Adulteration Act, or is transmitted to the chief analyst for analysis.

If the fertilizer is put up in packages, every such package intended for sale or distribution within Canada shall have the manufacturer's certificate of analysis placed upon or securely attached to each package by the manufacturer; if the fertilizer is in bags, it shall be distinctly stamped or printed upon each bag; if it is in barrels, it shall be either branded, stamped or printed upon the head of each barrel or distinctly printed upon good paper and securely pasted upon the head of each barrel, or upon a tag securely attached to the head of each barrel; if it is in bulk, the manufacturer's certificate shall be produced and a copy given to each purchaser.

No fertilizer shall be sold or offered or exposed for sale unless a certificate of analysis and sample of the same shall have been transmitted to the Minister of Inland Revenue and the provisions of the foregoing sub-section have been complied with.

Every person who sells or offers or exposes for sale any fertilizer, in respect of which the provisions of this Act have not been complied with—or who permits a certificate of analysis to be attached to any package, bag or barrel of such fertilizer, or to be produced to the inspectors to accompany the bill of inspection of such inspector, stating that the fertilizer contains a larger percentage of the constituents mentioned in sub-section No. 11 of the Act than is contained therein—or who sells, offers or exposes for sale any fertilizer purporting to have been inspected, and which does not contain the percentage of constituents mentioned in the next preceding section—or who sells or offers or exposes for sale any fertilizer which does not contain the per-

centage of constituents mentioned in the manufacturer's certificate accompanying the same, shall be liable in each case to a penalty not exceeding fifty dollars for the first offence, and for each subsequent offence to a penalty not exceeding one hundred dollars. Provided always that deficiency of one per centum of the ammonia, or its equivalent of nitrogen, or of the phosphoric acid, claimed to be contained, shall not be considered as evidence of fraudulent intent.

The Act passed in the forty-seventh year of Her Majesty's reign, chaptered thirty-seven and entitled, "*An Act to prevent fraud in the manufacture and sale of agricultural fertilizers*," is by this Act repealed, except in regard to any offence committed against it or any prosecution or other act commenced and not concluded or completed, and any payment of money due in respect of any provision thereof.

A copy of the Act may be obtained upon application to the Department of Inland Revenue, as well as a copy of a Bulletin which it is proposed to issue in April, 1888 concerning the fertilizers.

E. MIALL,
Commissioner.

January, 1889.

PROPERTIES FOR SALE.

Parties having developed or undeveloped mineral lands for sale will find the REVIEW an admirable medium for bringing them before the notice of CAPITALISTS and INVESTORS in GREAT BRITAIN and the UNITED STATES.



THE Intercolonial Railway

OF CANADA.

The Royal Mail Passenger & Freight
Route between Canada and
Great Britain,

—AND—

Direct route between the West and all points on the Lower St. Lawrence and Baie des Chaleurs; also New Brunswick, Nova Scotia, Prince Edward Island, Cape Breton and Newfoundland.

New and Elegant Buffet Sleeping and Day Cars run on through Express Trains.

Passengers for Great Britain or the Continent by leaving Toronto by 8 00 A.M. train Thursday will join Outward Mail Steamer at Halifax Saturday.

Superior Elevator, Warehouse and Dock accommodation at Halifax for shipment of grain and general merchandise.

Years of experience have proved the Intercolonial, in connection with steamship lines to and from London, Liverpool and Glasgow to Halifax, to be the quickest freight route between Canada and Great Britain.

Information as to Passenger and Freight rates can be had on application to

E. KING,
27 Sparks Street,
OTTAWA.

G. W. ROBINSON,
Eastern Passenger Freight Agent,
137½ St. James St., MONTREAL.

D. POTTINGER,
Chief Superintendent.

Railway Offices, Moncton, N.B.
Nov. 20th, 1888.

The Polson Iron Works Co'y

TORONTO, ONT.

Manufacturers of the Celebrated "Brown Automatic Engine."

GENERAL DEALERS IN

MINING MACHINERY.

SPECIAL AGENTS FOR

Knowles' Steam Pumps,

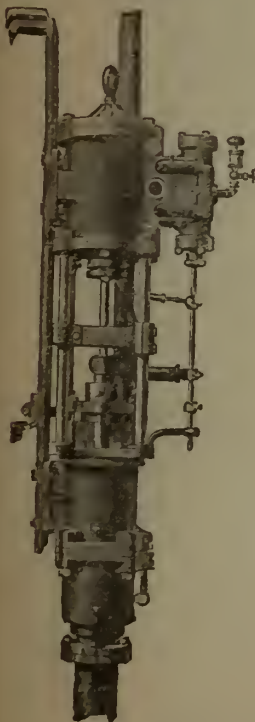
B. T. Sturtevant's Blowers and Fans,

Burleigh Rock Drills.

Hoisting Engines and Boilers, Quartz Mills, Diamond Prospecting Drills, Rock Breakers.

Office and Works, Esplanade E.; Warehouse, 38 Yonge St.,

TORONTO.



RUSSELL & CO.

PROVINCIAL AND DOMINION
LAND SURVEYORS,
CIVIL AND MINING ENGINEERS,
PORT ARTHUR, ONTARIO.

Mining Properties Surveyed, Reported on and Dealt in

Latest and Most Complete Plans of Thunder Bay
Mining District Always on Hand.

A. L. RUSSELL, A. H. MACDOUGLL, W. W. RUSSELL
P. L. S., D. L. S. P. L. S., D. L. S. M.E.A.-MCAN.SOC.C.E

FOR SALE.

Asbestos Mines.

On Lots 27, 28 and 29, in Range A, of Colrairie,
Megantic County, P. Q.

300 ACRES,

One Mile from Quebec Central Railway.

Free from Reserves or Royalties.

James Reed,

Reedsdale, Megantic, P. Q.



MONEY ORDERS.

MONEY ORDERS may be obtained at any
Money Order Office in Canada, payable in
the Dominion; also in the United States, the Unit-
ed Kingdom, France, Germany, Italy, Belgium,
Switzerland, Sweden, Norway, Denmark, the
Netherlands, India, the Australian Colonies, and
other countries and British Colonies generally.

On Money Orders payable within Canada the
commission is as follows:

If not exceeding \$4.....	2c.
Over \$4, not exceeding \$10.....	5c.
" 10, " " 20.....	10c.
" 20, " " 40.....	20c.
" 40, " " 60.....	30c.
" 60, " " 80.....	40c.
" 80, " " 100.....	50c.

On Money Orders payable abroad the commis-
sion is:

If not exceeding \$10.....	10c.
Over \$10, not exceeding \$20.....	20c.
" 20, " " 30.....	30c.
" 30, " " 40.....	40c.
" 40, " " 50.....	50c.

For further information see OFFICIAL POSTAL
GUIDE.

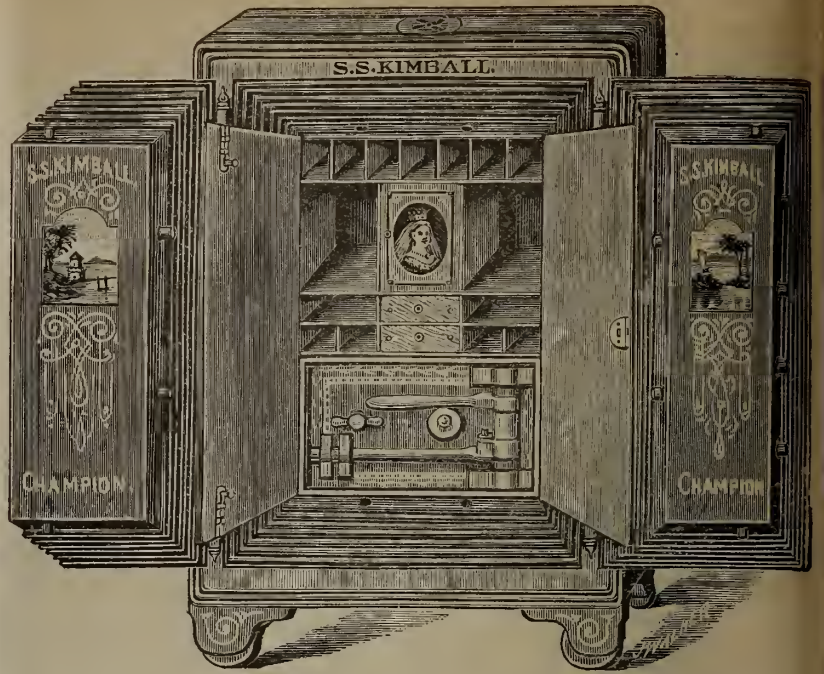
Post Office Department, Ottawa.
15th Sept., 1888.

Champion Fire and Burglarproof Safes.

These Safes have the best record of any in the Dominion. Price 30
per cent. cheaper than any other first-class Safe.

SEND FOR CATALOGUE AND PRICE-LIST.

S. S. KIMBALL,
577 Craig St., Montreal.



Van Duzen Steam Jet Pump.

MINING.—Our \$16 Pump preferred to a \$200 Steam Pump.

STATE OF MAINE ASSAY OFFICE,
F. L. BARTLETT,
PORTLAND, ME., June 21, 1883.



"GENTLEMEN,—The No. 5 'L' (\$16) Steam Jet Pump I purchased of you I have
used for raising water from a mining shaft fifty feet deep. I set it to draught twelve and force
thirty eight feet. It worked very well indeed, although I was obliged to carry steam 150 feet
from the boilers and in weather often below zero. I carried 75 pounds of steam at the boiler,
and the Jet Pump took the place of a No. 3 K (\$200 Piston Pump), that I had to remove.

"Yours truly,

F. L. BARTLETT."

Address for further particulars,

CARTH & CO.,

MONTREAL

USE GURNEY'S IMPROVED CELEBRATED Hot Water Heaters!

Guaranteed more Economical than any other
Heater now made, and containing every
known Improvement in Hot
Water Heating.

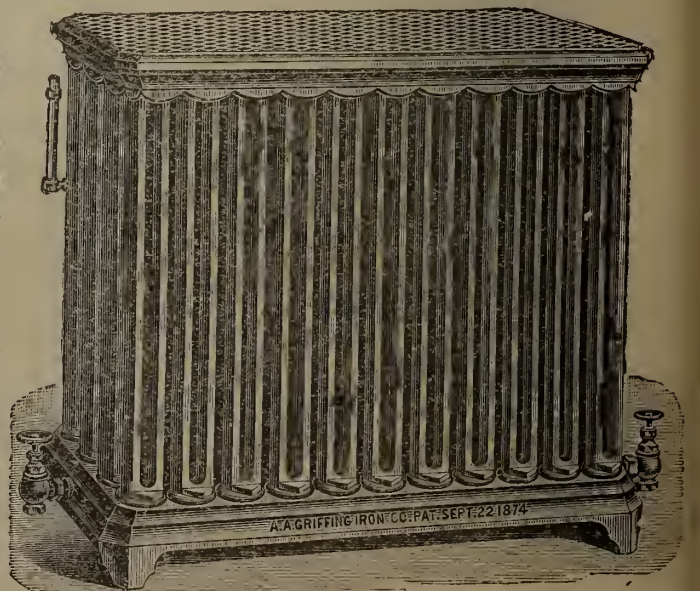
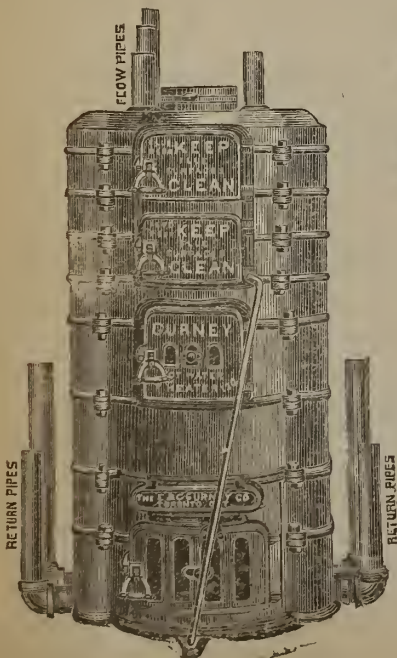
STEAM FITTINGS, CAST IRON PIPE,
REGISTER, GRATES, ETC.

HOT AIR FURNACES

FOR COAL OR WOOD

E. & C. GURNEY & CO.,

MONTREAL.



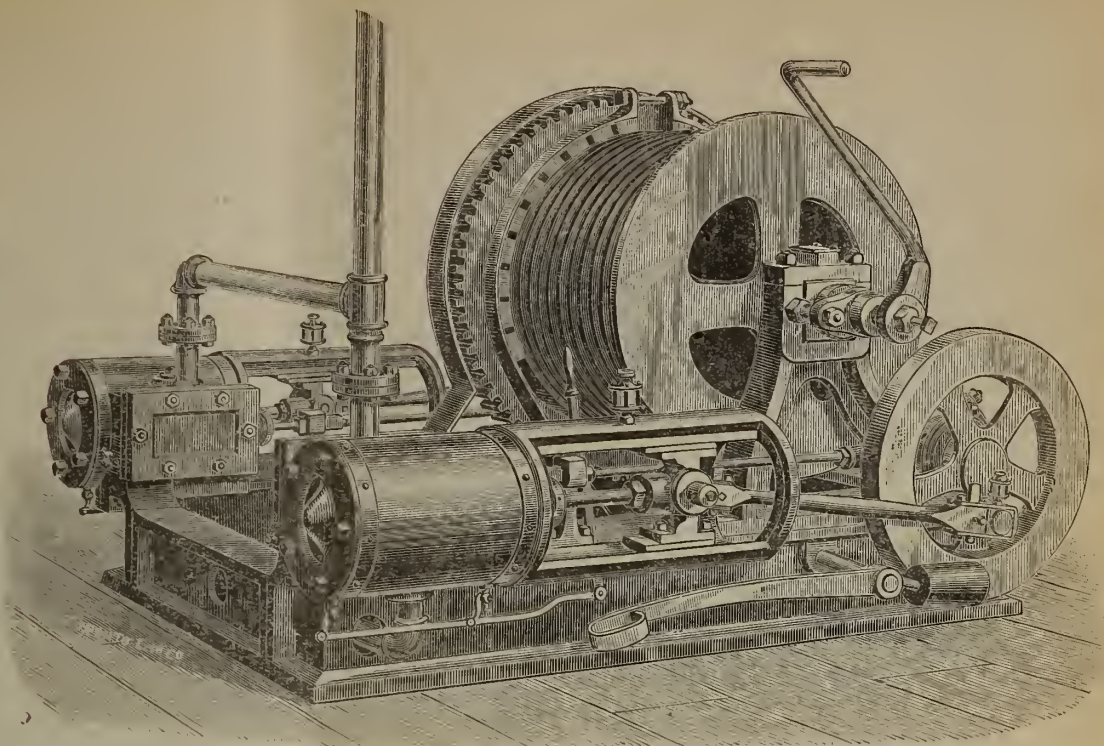
Bundy Radiators for Quick Circulation and Economy of Space.

JOHN DOTY ENGINE CO.

Toronto, Ont.

MANUFACTURERS OF

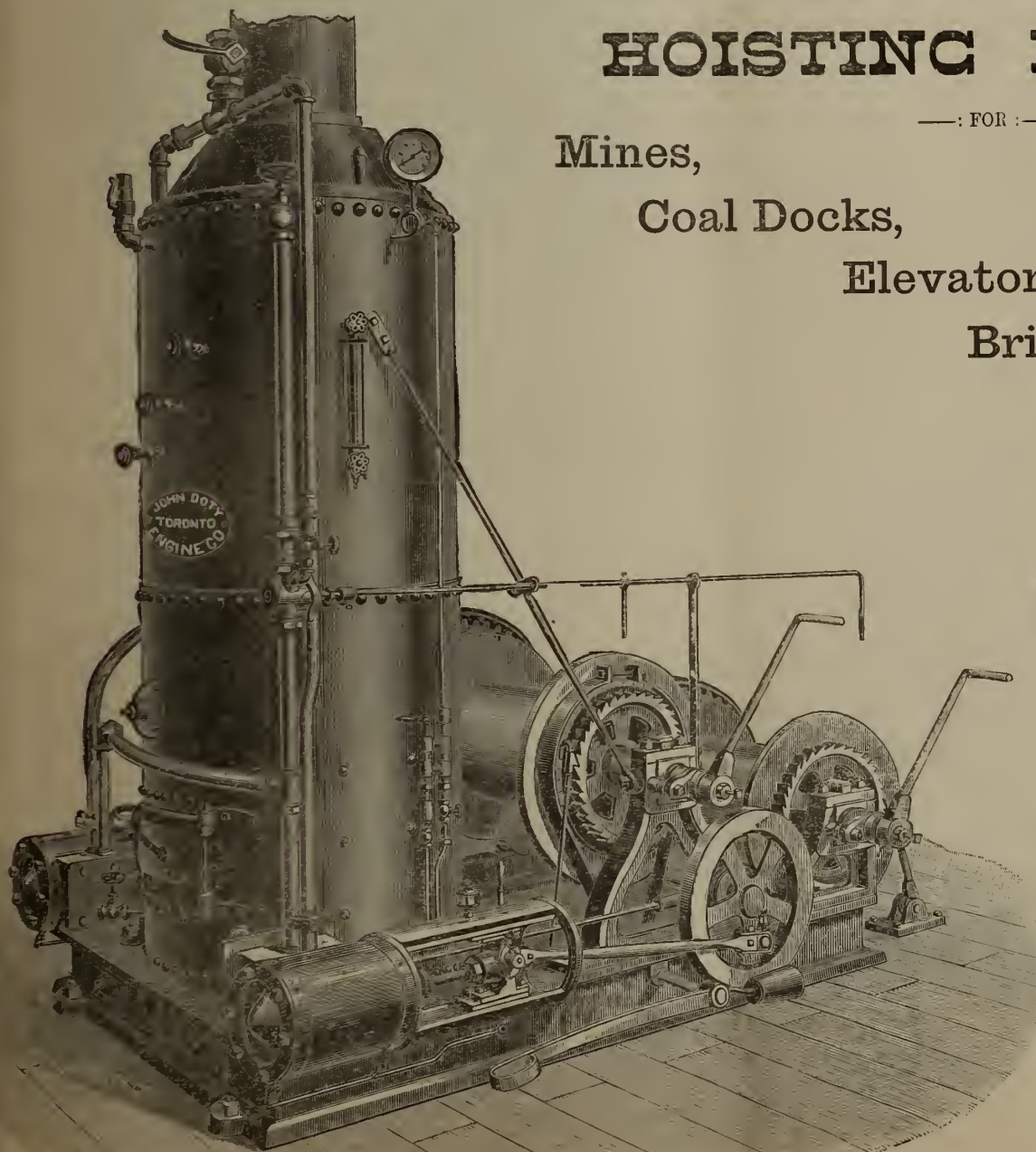
Mining & General
Machinery.



HOISTING ENGINES

—: FOR :—

Mines,
Coal Docks,
Elevators,
Bridge Builders,
Contractors, &c.



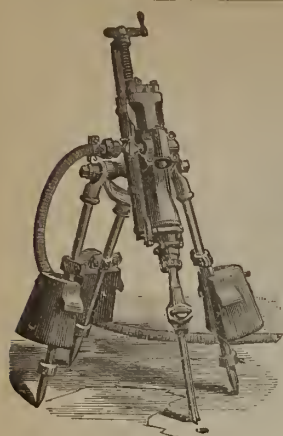
CORLISS ENGINES

Tug & Steam Yacht Engines,
Mill Engines.

Shafting & Mill
Gearing.

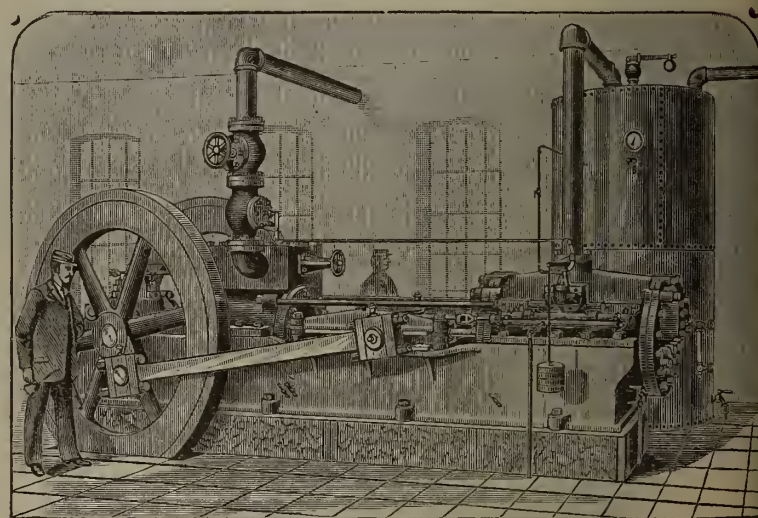
All Descriptions of Boiler
and Tank Work.

Send for Estimates and
Catalogues.

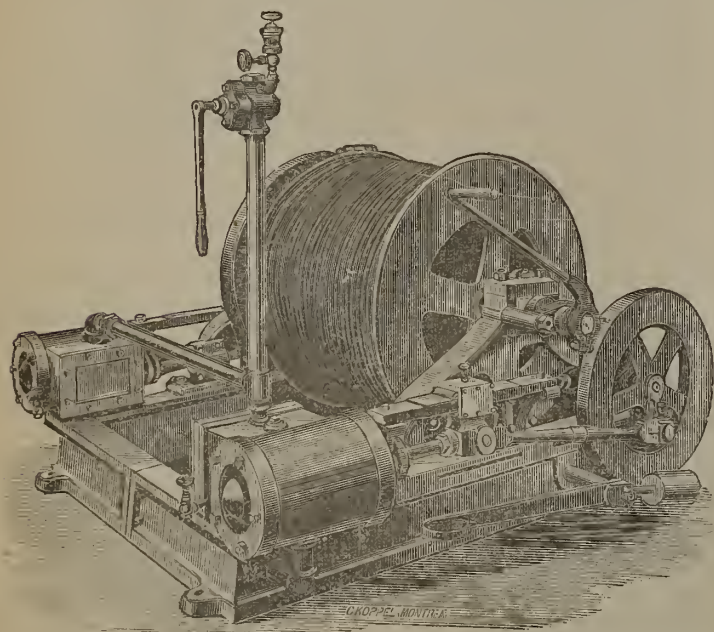


INGERSOLL
ROCK DRILL COMP'Y
OF CANADA
MANUFACTURERS OF

Rock Drills,
Air Compressors,
Steam & Horse Power Hoists,
BOILERS,
—AND—
GENERAL MINING
—AND—
Quarrying Machinery
—AND—
Contractors' Plant.



— ALSO —



Drill Steel, Wire Rope,
Derrick Castings,
Steam & Air Hose & Couplings,
Iron Piping, Fittings,
—AND—
ALL KINDS OF SUPPLIES
—FOR—
Miners & Contractors' Work.

For Estimates, Catalogues and information address

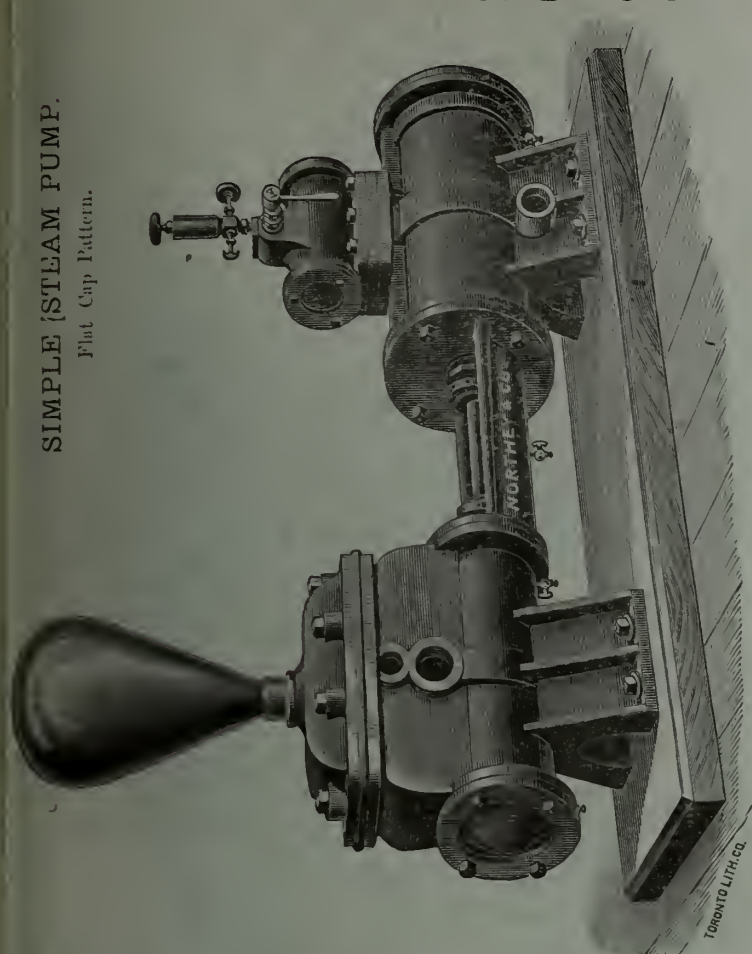
Ingersoll Rock Drill Co. of Canada.

204 : James Street, or P.O. Box 1942, Montreal.

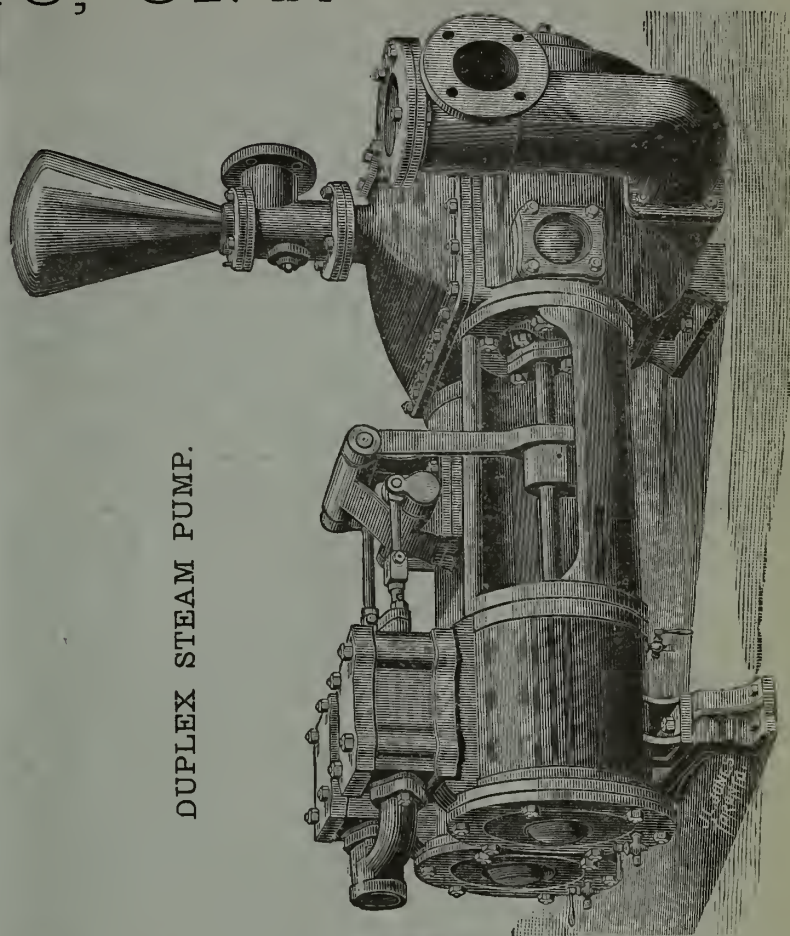
Northey & Co's Steam Pump Works, TORONTO, ONT.

SIMPLE STEAM PUMP.

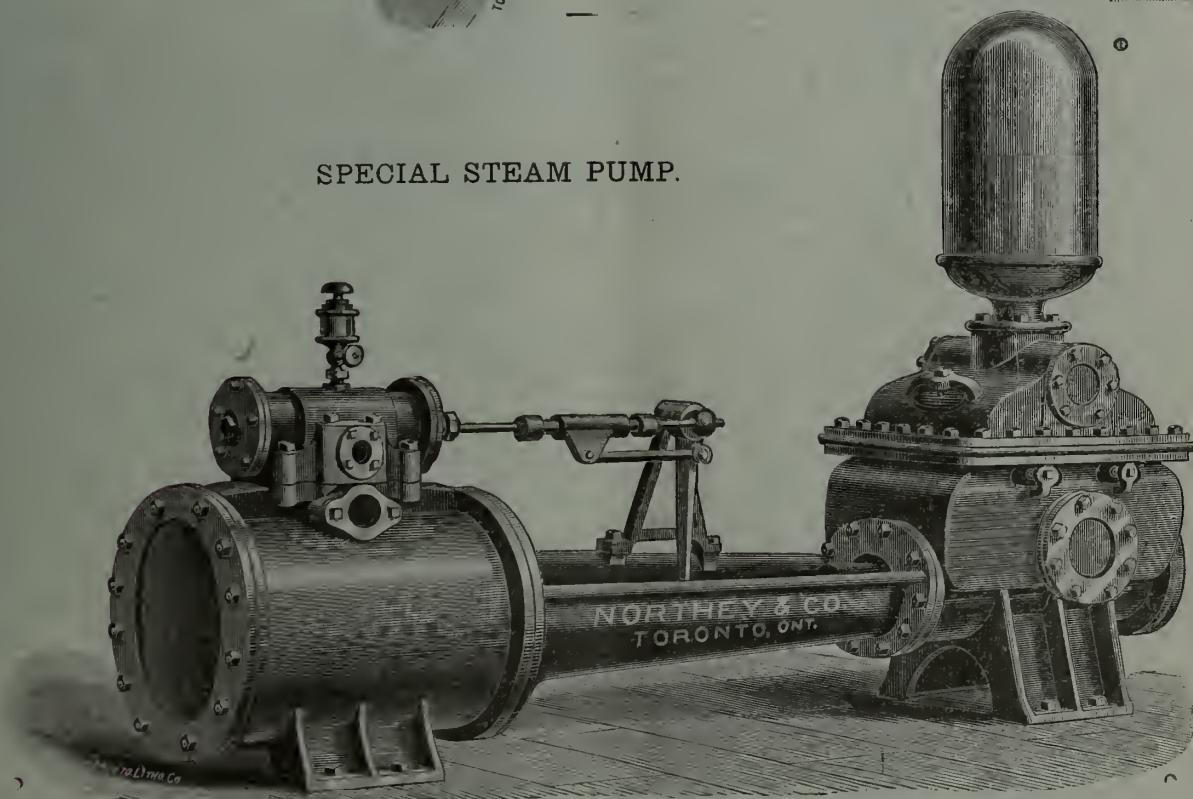
Flat Cap Pattern.



DUPLEX STEAM PUMP.



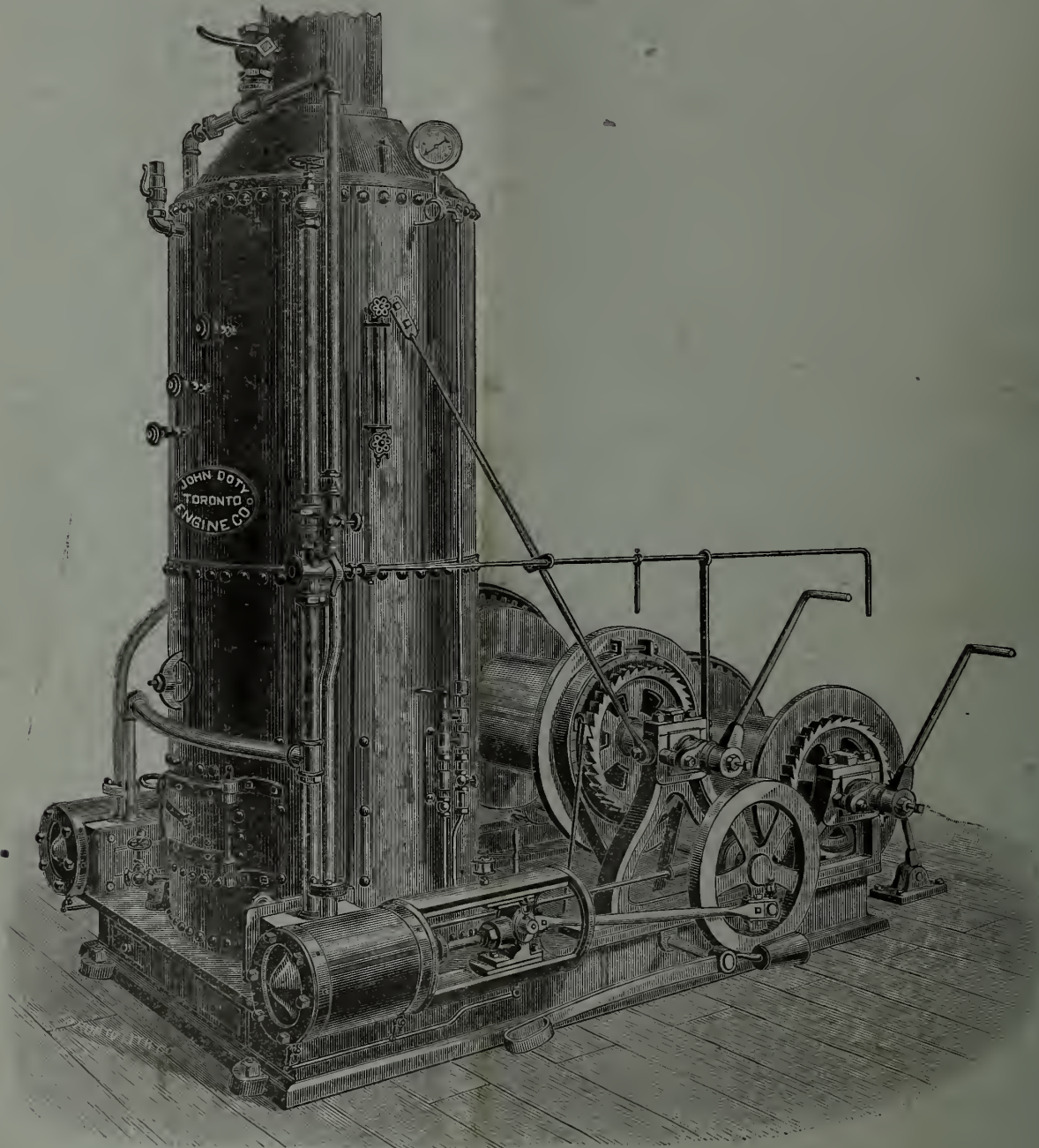
SPECIAL STEAM PUMP.



Steam Pumps of the best and latest designs for mining purposes, Boiler Feeding, Fire Protection, and General Water Supply, etc.

NORTHEY & CO.,
Mechanical  Hydraulic Engineers, Toronto, Ont.
WORKS—COR. FRONT AND PARLIAMENT STS.

A. R. WILLIAMS,
SOHO MACHINE WORKS,
TORONTO, ONTARIO.
MANUFACTURER AND DEALER IN
MACHINERY AND SUPPLIES.



Duplex Steam Pumps, all sizes. Every Pump Guaranteed.
VERY LOW PRICES.

Portable Engines, Hoisting Engines, Stationary Engines, Iron
and Wood Working Machinery, Ventilating Fans, Saw Mill
and Shingle Mill Machinery. Full lines of Machinery and
Supplies. Send for Catalogue.

MINING REVIEW

Canadian

Established 1882

Vol. VIII.—No. 5.

1889.—OTTAWA, MAY—1889.

Vol. VIII.—No. 5

1889 CATALOGUE OF 200 PAGES, 1889
—A—
A TREATISE AND HANDBOOK
—ON—
Rock Drilling and Air Compressing
MAILED FREE.
RAND DRILL CO.,
23 PARK PLACE, NEW YORK.

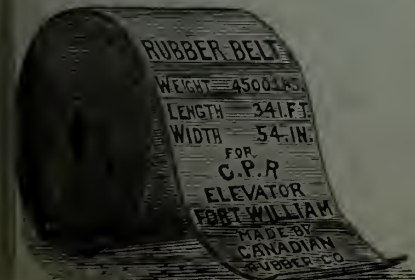
Hamilton Powder
COMPANY,
Manufacture Mining, Blasting, Military
and Sporting
Gunpowder,
DYNAMITE, DAULIN, and the new
ECLIPSE MINING POWDER

DOMINION AGENTS FOR
Safety Fuse, Electric Blasting
Apparatus, &c.
OFFICE
103 ST. FRANCOIS XAVIER STREET
MONTREAL.

BRANCH OFFICES & MAGAZINES
at all chief distributing points
in Canada.

THE CANADIAN RUBBER CO.
OF MONTREAL.

A. ALLAN, Pres. J. O. GRAVEL, Secy.-Treas. F. SCHOLES, M'g. Dir.



Western Branch cor. Front and Yonge Sts.,
TORONTO.

CANADA ATLANTIC
RAILWAY.
THE SHORTEST PASSENGER ROUTE
BETWEEN
Ottawa and Montreal,
AND ALL POINTS EAST & SOUTH.

The only road in Canada running trains lighted
with electricity and heated by steam from the
engine. Luxurious Buffet Pullman Palace Cars
on all trains between Ottawa and Montreal. Only
line running through Sleeping Cars between

Ottawa, Boston and New York

And all New England and New York points.
Baggage checked to all points and passed by Cus-
toms in transit.

During season of navigation close connections
are made with Richelieu and Ontario Navigation
Company's Steamers at Coteau Landing, shooting the
St. Lawrence Rapids.

For Tickets, Time Tables and information apply
to nearest agent, or to

S. EBBS, City Passenger Agent,
24 Sparks St., OTTAWA.
GEO. H. PHILLIPS, Gen. Agent,
VALLEYFIELD.

A. E. CAIRNS, General Agent,
136 St. James St., MONTREAL.
Or at 260 Washington St., Boston, and
317 Broadway, New York.

PERCY R. TODD,
General Passenger Agent.

E. J. CHAMBERLIN,
General Manager,
General Offices, Ottawa.

COPELAND & BACON.
MANUFACTURERS OF
HOISTING ENGINES,
and MINING PLANTS.
85 Liberty St.
NEW YORK.
Send for Catalogue.

MILLER BROS. & MITCHELL
MANUFACTURERS OF
Steam Rock Drills
AND
HOISTING ENGINES,
Mining & Contractors' Plant
&c., &c.
110 TO 120 KING STREET, MONTREAL, QUE.

THE
BELL TELEPHONE CO.
OF CANADA.

ANDREW ROBERTSON, - - - PRESIDENT
C. F. SISE, - - - VICE-PRESIDENT
C. P. SCLATER, - SECRETARY-TREASURER

HEAD OFFICE, - MONTREAL.
H. C. BAKER, Manager Ontario Department,
HAMILTON.

This Company will sell its instruments at prices
ranging from \$10 to \$25 per set. These instru-
ments are under the protection of the Company's
patents, and purchasers are therefore entirely free
from risk of litigation.

This Company will arrange to connect places
not having telegraphic facilities with the nearest
telegraph office, or it will build private lines for
firms or individuals, connecting their places of
business or residences. It is also prepared to
manufacture all kinds of electrical apparatus.

Full particulars can be obtained at the Com-
pany's offices as above, or at St. John, N.B., Hal-
ifax, N.S., Winnipeg, Man., Victoria, B.C.

REMINGTON
STANDARD
TYPEWRITER

Miss Orr, Championship
of the world and Gold Medal
at Toronto, 13th August,
1888.

GEORGE BENGOUGH,
GENERAL AGENT,
36 King Street, TORONTO.

ALEX. FLECK, JUN.,
Manufacturer of every Description of
Mill Machinery
Water Wheels, Steam Engines,
Boilers, Derrioks, Steam
Pumps and Mining
Machinery.
Brass and Iron Casting of every
Description.
VULCAN IRON WORKS, WELLINGTON ST
OTTAWA.

DYNAMO ELECTRIC
MACHINES and LAMPS

THE
BALL ELECTRIC LIGHT CO.
MANUFACTURERS OF
ELECTRIC LIGHTING APPARATUS
57, ADELAIDE ST. W.
TORONTO
ONT.

ARC and INCANDESCENT
FOR MINING PURPOSES

New York Belting & Packing Co.

15 PARK ROW, NEW YORK

JOHN H. CHEEVER, Treasurer.

J. D. CHEEVER, Dep'y Treasurer.

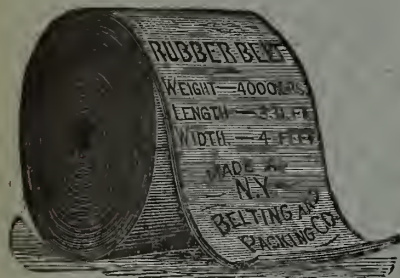
Oldest and largest Manufacturers in the United States of

VULCANIZED RUBBER FABRICS

FOR MECHANICAL PURPOSES.

EXTRA RUBBER BELTING AND HOSE

FOR MINING PURPOSES.



RUBBER BELTING.

CIRCULAR WOVEN SEAMLESS, ANTI-SEPTIC RUBBER LINED

"CABLE" HOSE and TEST HOSE

For the use of Steam Engines, Force Pumps, Rolling Mills, Iron Works, Factories, etc. Woven in a superior manner to insure wear, compactness and durability.



"TEST HOSE."



Emery Vulcanite Wheel.

SOLID VULCANITE EMERY WHEELS

(Large Wheels made on iron centers)

Cuts Cooler and Freer than any other wheel in the market.

W. D. ALLEN & CO.,
151 Lake St., Chicago.

H. D. EDWARDS & CO.,
Detroit.

European Branch: Pickhuben, , Hamburg Freihafengebeit),Germany.

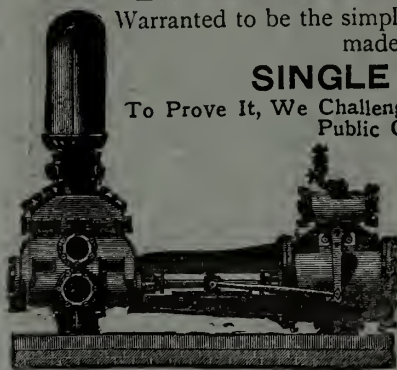
The M. T. DAVIDSON

IMPROVED MINING PUMP.

Warranted to be the simplest and most efficient Steam Pump made, whether it be

SINGLE OR DUPLEX.

To Prove It, We Challenge All Makers of Steam Pumps to a Public Competitive Test.



COMPOUND PUMPING ENGINES,

Obtaining a higher duty than any direct-acting pump made.

MANUFACTURED BY THE

Davidson Steam Pump
COMPANY,

New York Office, - - - 77 Liberty Street.

ROOT'S

SPIRAL RIVETED PIPE

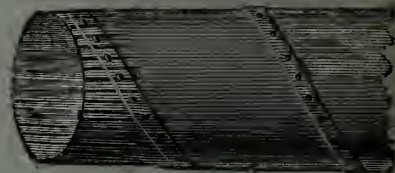
FOR

Hydraulic Mining,

Water Works

Ranch and Railroad

Water Supplies.



From 2 to 24 inches in diameter and 1 to 25 in length. Manufactured with fittings to suit, capable of withstanding any desired pressure.

ABENDROTH & ROOT MFG. CO.

28 Cliff Street, New York.

Chicago Branch, - - SMITH & KNAPP, 62 South Canal Street

LIDGERWOOD MANUF'G CO.

96 LIBERTY ST, NEW YORK,

Largest Manufacturers in the United States of Hoisting Machinery of Every Description for Mines, Tunnel Work, Contractors, and General Hoisting Purposes.

IMPROVED HOISTING ENGINES

FOR MINING PURPOSES A SPECIALTY.

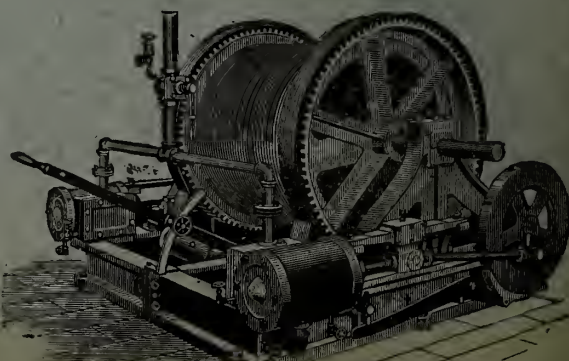
Over 5,000 Engines in Use!

300 Styles
and Sizes.

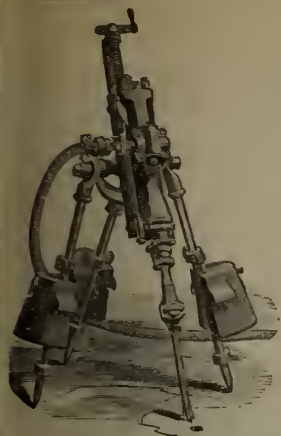
Send for
CATALOGUE.



FRICTION DRUM PORTABLE HOISTING ENGINE.

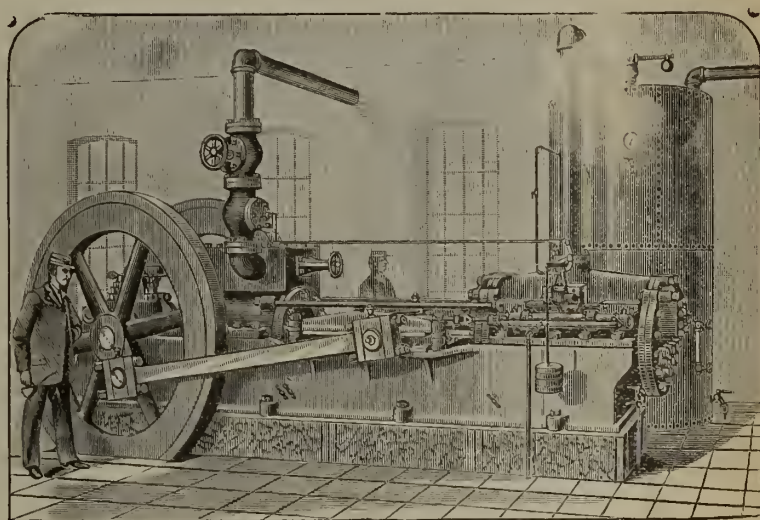


Double Cylinder Reversible Mine Engine.



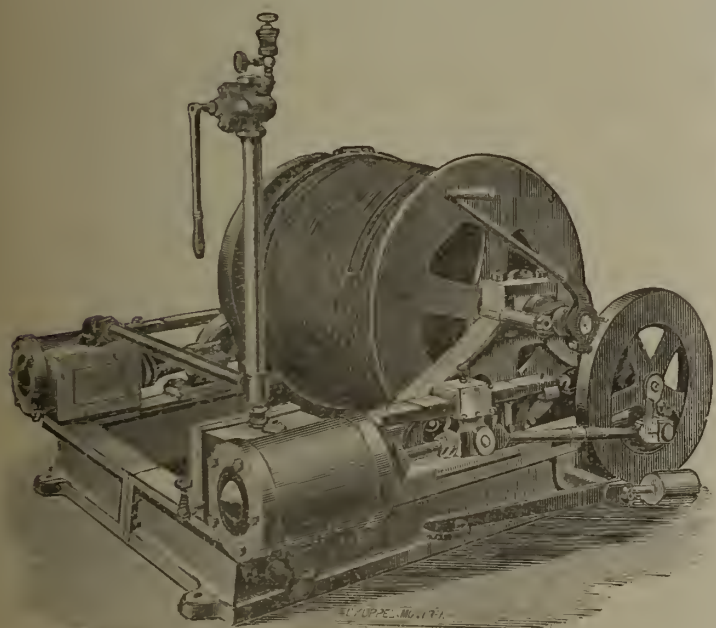
INGERSOLL
ROCK DRILL COMP'Y
OF CANADA
MANUFACTURERS OF

Rock Drills,
Air Compressors,
Steam & Horse Power Hoists,
BOILERS,
—AND—
GENERAL MINING
—AND—
Quarrying Machinery
—AND—
Contractors' Plant.



—ALSO—

Drill Steel, Wire Rope,
Derrick Castings,
Steam & Air Hose & Couplings,
Iron Piping, Fittings,
—AND—
ALL KINDS OF SUPPLIES
—FOR—
Miners & Contractors' Work.



For Estimates, Catalogues and information address

Ingersoll Rock Drill Co. of Canada.

204 St. James Street, or P.O. Box 1942, Montreal.

F. G. BECKETT ENGINE CO.

HAMILTON, ONT.



Having had many years practical experience in the manufacture of

MINING MACHINERY

IS NOW PREPARED TO CONTRACT FOR

Stamp Mill Machinery,
Concentration Mills,
Revolving, Roasting and
Drying Furnaces.
Rock Breakers,
Cornish Rolls for crushing,
Amalgamating Pans and Settlers,
Concentrators and
Revolving Screens,
Smelting Furnaces, Retorts,

HOISTING ENGINES,

EITHER GEARED OR DIRECT ACTION.

Cornish Pumping Machinery,
Iron Ore Cars, Safety Cages, &c.,
Rock Drills and Air Compressors.

STEAM ENGINES AND BOILERS.

Marine Engines and Steam Yachts.

Francis D. Taylor
MINING ENGINEER,
BROCKVILLE, - ONTARIO

SPECIALTY. — The Mining of Iron Ores,
and the Manufacture of Iron and Steel.
Mr. T. has had for many years the manage-
ment of large mining enterprises in England
and the U. S. A.

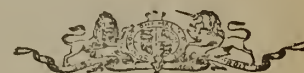
CAMERON STEAM PUMP
SIMPLE, RELIABLE, COMPACT, DURABLE.
NO OUTSIDE VALVE GEAR.
ADAPTED FOR ALL PURPOSES.
THE A. S. CAMERON STEAM PUMP WORKS.
FOOT OF EAST 23rd STREET, NEW YORK.



**THE DOMINION
Leather Board Co.**
MONTREAL,

—MANUFACTURERS OF—
Leather Board & Stiffeners
ALSO OF
**ASBESTOS MILL BOARD,
STEAM PACKING, and
FRICTION PULLEY BOARD.**

Samples and prices furnished upon ap-
plication.
Please mention this paper.



**ONTARIO
Mining Regulations.**

The following summary of the principal provisions of the General Mining Act of the Province of Ontario is published for the information of those interested in mining matters in the Algoma District, and that part of the Nipissing District north of the Mattawan River, Lake Nipissing and French River.

Any person or persons may explore for mines or minerals on any Crown Lands surveyed or unsurveyed, not marked or stake out or occupied.

The price of all lands sold as mining locations or as lots in surveyed townships is two dollars per acre cash, the pine timber being reserved to the Crown. Patentees or those claiming under them may cut and use such trees as may be necessary for building, fencing or fuel, or for any other purpose essential to the working of mines.

Mining locations in unsurveyed territory shall be rectangular in shape, and the bearings of the outlines thereof shall be due north and south, and due east and west astronomically, and such locations shall be one of the following dimensions, viz: eighty chains in length by forty chains in width, containing 320 acres, or forty chains square, containing 160 acres, or forty chains in length by twenty chains in width, containing 80 acres.

All such locations must be surveyed by a Provincial Land Surveyor, and be connected with some known point or boundary at the cost of the applicant, who must file with application surveyor's plan, field notes and description of location applied for.

In all patents for mining locations a reservation of five per cent. of the acreage is made for roads.

Lands patented under the Mining Act are free from all royalties or duties in respect to any ores or minerals thereon, and no reservation or exception of any mineral is made in the patents.

Lands situated south of the Mattawan River, Lake Nipissing and French River are sold under the Mining Act at one dollar per acre cash.

Affidavits showing no adverse occupation, improvement or claim should accompany applications to purchase.

A. S. HARDY,
Commissioner.
Department of Crown Lands, Toronto.

PHOSPHATE LANDS.

South half Lot 10, 9th Range, Buckingham, or the Mines thereon, will be sold out and out cheap for cash. One mile from the River, five from Buckingham Village. Good roads; three good "Shows" and several smaller ones.

Apply to
S. J. JONES, Buckingham
OR ON THE PREMISES.

**TAYLOR McVEITY,
Barrister, Solicitor, &c.,**
Supreme Court and Departmental Agent,
SCOTTISH ONTARIO CHAMBERS, OTTAWA.

WM. HAMILTON MERRITT, F.C.S.

Associate Royal School of Mines, &c.,
Mining Engineer and Metallurgist,
Will report on Mines and Mineral Properties.
ADDRESS:
15 TORONTO ST., TORONTO, ONT.

J. T. DONALD, M.A.,

Analytical Chemist and Assayer,
124 St. JAMES St. - MONTREAL.
Analyses and Assays of every description. Manufacturing processes practically tested. Laboratory instruction in Chemistry, Assaying and Mineralogy. Terms on application.

The Canada Co.

Will issue Licences to Prospect or to work Minerals on any of their Mining Lands and Mineral Reservations,

Covering nearly a

Quarter of a Million Acres

In Eastern Ontario, and principally within the belts containing

Iron, Phosphate, Gold, Galena
Plumbago, Mica, Marbles,
Building Stone,
and other valuable Minerals.

For list of lands and terms apply to the Company's Mining Inspectors,

H. T. STRICKLAND,
Peterborough, Ont.,

For lands in the County of Hastings and westward, and to

ANDREW BELL, P.L.S.,
Almonte, Ont.,

For lands East of the County of Hastings.

TO MINERS AND OTHERS.

Bannerman & Powers,

VULCAN BOILER WORKS,

428 and 340 Wellington St., Ottawa.

MANUFACTURERS OF

IRON AND STEEL BOILERS

OF EVERY DESCRIPTION.

Tanks, Girders, Iron Roof-
ing, Bank Vaults, Smoke
Stacks

—AND ALL KINDS OF—

SHEET IRON WORK.

Repairs Neatly and Promptly Executed

FENWICK & SCLATER,

Manufacturers of Asbestos, Fire Hose, Files and Cotton
Waste, Miners of Asbestos and Soapstone,

ASBESTOS

Cotton, Leather and Rubber Belting,

42, 44 & 46 Foundling Street, Montreal.

H. R. IVES & CO.,

Hardware Manufacturers and Founders,
QUEEN ST., MONTREAL.

STOVES.	PORTABLE FORGES.	MONTREAL SMELTING CO'S	CASTINGS
TRADE MARK "Buffalo"	IRON	BABBIT METAL.	Of every description to order.
BEDSTEADS	BLACKSMITH'S DRILLS.		SOIL PIPE.
FOR MINERS' USE.			

PORTABLE ENGINES AND SAW-MILLS

Of all capacities—from 3000 feet of lumber and up per day.

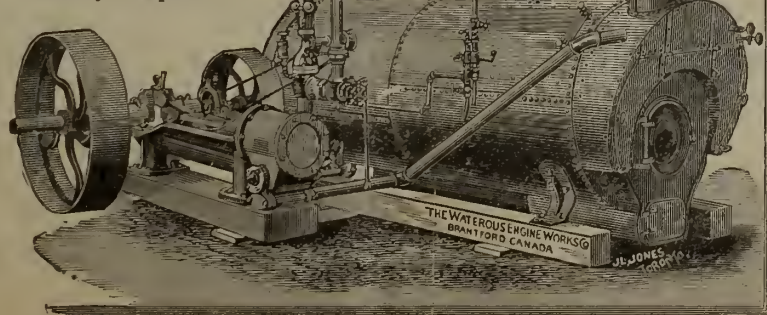
Saw-Mills.
Shingle-Mills.
Lath-Mills.
Chopping-Mills.

ENGINES
OF ALL SIZES.

BOILERS

of all capacities,
IRON OR STEEL,
ALL STYLES.

Send for Circulars, stating what you require.



Waterous Engine Works Co. Brantford, Canada.
St. Paul, Minn., U.S.A.

ASBESTOS.

THEO. HAMEL,

44 Mountain Hill, Quebec,

SOLE ASBESTOS MANUFACTURER in CANADA

Write for prices and catalogue. Use Asbestos and save your money. Applied on boilers and Steam pipes it will prevent them from rusting and will economize 33% on fuel.

WILSON & GREEN,

Commission Merchants,

PHOSPHATE SHIPPERS.

AGENTS HIGH ROCK MINE.

30 St. François Xavier St., - MONTREAL.

EDMUND SPARGO,

Consulting and Mining Engineer, 3 Cable Street, Liverpool.

Owners of or Investors in Metalliferous Mines, Slate, Granite, and other Stone Quarries, Brick, Terra Cotta, Fire and other Clays and Mineral Estates in general, requiring reliable and sound advice either in the Purchase or Disposal thereof, should consult E.S., who has executed important professional Commissions in Germany, Austria, Hungary, France, Belgium, Spain, Portugal, Sweden, Norway, and in the various Mining Districts throughout Great Britain and Ireland. Telegraphic Address: "Spargo," Liverpool. Bankers, National Provincial Bank of England, Liverpool.

THOMAS HEYS,

Analytical and Consulting Chemist and Assayer.

References are kindly permitted by the following: Messrs. Gooderham & Worts, Toronto, Limited; Messrs. P. R. Lamb & Co., John Livingston, Esq., Dominion Bolt Co.

Assay and Metallurgical Laboratory, 16 King St. W., the Rossin House, } TORONTO.

J. LANSON WILLS,

F. C. S., ETC.

Manager of the Canadian Phosphate Co. (Lim.),

Will shortly be disengaged, and offers his services to examine and report upon Mines and Mining properties. Advice given on Chemical and Metallurgical processes.

SPECIALTIES: PHOSPHATE AND GOLD.

TELEGRAPHIC OR POSTAL ADDRESS:

WILLS, BUCKINGHAM, P.Q.

Irwin, Hopper & Co.

MINERS AND SHIPPERS OF MINERALS,

30 St. Francois Xavier Street,

MONTREAL, CAN.

Asbestos, crude and manufactured. Phosphate, Mica, Plumbago, Soapstone, &c.

DOMINION ASSAY OFFICE,

Gold and Silver Ores and Bullion

ASSAYED, REFINED AND PURCHASED.

Mining Properties bought, sold and examined. Fifteen years experience in Australia, New Zealand and California.

44 VICTORIA STREET, - - TORONTO.

H. ANN, PROP.

JAMES HOPE & CO.

BOOKSELLERS,

Stationers, Bookbinders and Printers,

OTTAWA.

SPEIGHT & VanNOSTRAND,

Dominion and Provincial Land Surveyors, Draughtsmen, Valuers, &c.

OFFICE: ROOM "J," FIRST FLOOR, TORONTO ARCADE, YONGE ST., TORONTO.

Surveys, Plans, Descriptions of Properties, etc., promptly executed. Timber Limits and Mining Claims Located.

MILLAR & CO.

General Merchants & Shipping Agents

ATLANTIC CHAMBERS,

209 COMMISSIONER ST., - MONTREAL

Cable address, "Hoyer, Montreal." P.O. Box 1095.

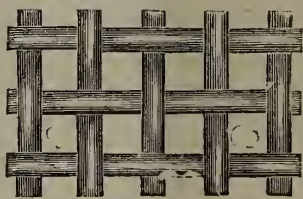
AGENT FOR The Canadian Phosphate Co., Ltd., of London, Eng., The Montreal Union Abattoir Co., of Montreal, Can.

English Correspondents Messrs. Couper, McCamie & Co., London, England.

DEALERS in Canada Phosphate, Ground Phosphate, Sulphate of Ammonia, Nitrate of Soda, Spent Bone Black, Hoofs and Horns, Fertilizers, Tankage, Dried Blood, Grease, Bones, Hair, etc., etc.



For Mining Hoisting Derricks, etc.



Strong Wire Cloth and Screens

For Mining, etc., manufactured by

B. Greening & Co.

HAMILTON, ONT.

NATIONAL COLONIZATION

Lottery!

UNDER THE PATRONAGE OF

THE REV. FATHER LABELLE.

Established in 1884 under the Act of Quebec, 31 Vict., Chap. 36, for the benefit of the Diocesan Societies of Colonization of the Province of Quebec.

CLASS D.

DRAWINGS ON THIRD WEDNESDAY IN EVERY MONTH AT 2 P.M.

Prizes value \$50,000

Capital Prize: 1 Real Estate worth \$5,000.

LIST OF PRIZES.

1 Real Estate worth	\$5,000	\$5,000
1 Real Estate worth	2,000	2,000
1 Real Estate worth	1,000	1,000
4 Real Estates	500	2,000
10 Real Estates	300	3,000
30 Furniture Sets	200	6,000
60 Furniture Sets	100	6,000
200 Gold Watches	50	10,000
1000 Silver Watches	10	10,000
1000 Toilet Sets	5	5,000

2307 Prizes worth..... \$50,000

Tickets, \$1.00!

Offers are made to all winners to pay their prizes cash, less a commission of 10 p. c. Winners' names not published unless specially authorized.

S. E. LEFEBVRE, Secretary

Office: 19 St. James St., Montreal, Can.

W. Blakemore, F.G.S., M.E.,
Member of I. & S.I.

A. Montgomery Evans, M.E.
of Canada & U.S.

BLAKEMORE & EVANS,
MINING & CIVIL ENGINEERS

Exchange Buildings, Cardiff, S.W.

LONDON OFFICE:

Robert H. Jones, 82 Queen St., Cheapside, London, E.C.

Reports, Estimates, and Valuations made on Iron and Steel Works Blast Furnaces, and all classes of Mining Properties.

CANADIAN BUSINESS PROMPTLY ATTENDED TO

To Prevent Boiler Explosions

And other accidents to steam boilers, and to secure economy in working, insure with

THE BOILER INSPECTION
AND INSURANCE COMPANY OF CANADA.

Sir Alex. Campbell, K.C.M.G., | John L. Blaikie, Esq.
President. Vice-Pres.

HEAD OFFICE: - - - - - TORONTO

G. C. ROBB, Chief Engineer.

A. FRASER, Sec'y-Treas.

ORFORD COPPER CO.,

COPPER SMELTERS.

Works at Constable's Hook, N.J., opposite new Brighton, Staten Island. Copper Ore, Mattes, or Bullion purchased. Advances made on consignments for refining and sale. Specialty made of Silver-Bearing Ores and Mattes.

SELL

INGOT AND CAKE COPPER.

President, ROBERT M. THOMPSON,

Treasurer, G. A. LAND.

Office, 37 to 39 Wall Street, New York.

Robin & Sadler,

MANUFACTURERS OF

LEATHER BELTING.

TRY OUR

Waterproof Belting,

Just the thing for Mining Machinery.

MONTREAL,

TORONTO,

2513, 2520, 2522 Notre Dame St.

129 Bay Street.

STEEL IN STORE

Standard Durable Cast Steel. Best value for consumers.

Also Machinery Steel.

A. C. LESLIE & CO.,

Montreal and Toronto.

T. D. LEDYARD,

DEALER IN MINERAL LANDS
4 ONTARIO CHAMBERS, TORONTO.

Will buy undeveloped iron ore and other mineral properties. WANTED. — Deposits of Magnetic Iron Ore, Red Hematite, Brown Hematite, Galena, Iron and Copper Pyrites, Mica, Soap stone, Marble, Gypsum, Baryta. Samples can be sent by Sample Post for 1 cent for 4 oz. or up to 24 oz. in weight. Information regarding mines cheerfully given. Correspondence solicited. Crown Land Business attended to.

CHEMICAL APPARATUS! OF EVERY DESCRIPTION.



Glass, Porcelain, Stoneware, Platinum Crucibles of every sort, Analytical Scales and Weights, Fine Chemicals and Reagents, including Volumetric Solutions. Every requisite for Analysis or Experiment. For Sale by

LYMAN, SONS & CO.,
334 St. Paul St., Montreal.

Illustrated Catalogue mailed on receipt of 10c. or Business Card.

Boiler For Sale.

N EIGHTY H.P. TUBULAR STEEL BOILER made by W. C. White, Montreal, 15 ft. x 5 ft. 4 in. eighty 3 1/2 in. tubes; smoke stack 45 ft. long; guy-lards and guys. Very little used. Equal to new. Price on rs, \$600. Address

P. O. Box 6,
MONTREAL.

READ THIS CAREFULLY.

Those who EXPECT BENEFIT FROM USING MEAT PREPARATIONS should understand that EXTRACTS OF MEAT HAVE NO NUTRITIOUS VERTIES because THE ALBUMEN AND FIBRINE—the nutritious meats of meat—ARE INSOLUBLE, and CANNOT EXIST in a CLEAR LIQUOR such as EXTRACTS OF MEAT MAKE. THE SEDIMENT IN

JOHNSTON'S



FLUID BEEF

contains the NUTRITIOUS CONSTITUENTS OF MEAT, GET RID OF IT the CLEAR LIQUOR that is LEFT is only a MEAT FLAVOUR, and is NO MORE NUTRITION THAN A CUP OF COFFEE. This has been demonstrated again and again by scientific analysis.

Victor Electric Fuses.

superior to all others for Exploding any make of Dynamite, High explosives, or Gelatine Powder. Each Fuse is tested and warranted extra strong and waterproof. Low grades of Dynamite will do ten per cent. more execution if detonated with Victor Electric Fuses.

VICTOR BLASTING MACHINES.

Latest improvements, made in three sizes, easy to operate, strong and durable. No expensive repairs, low in price, will fire any make of Electric Fuses.

MANUFACTURED ONLY BY

JAMES MACBETH & CO.,

128 Maiden Lane, N.Y., U.S.A.

Send for Catalogue.

FOR SALE.

A COAL MINE IN CAPE BRETON,

Area, 970 acres, underlaid by 6 or 7 beds of the best coal in Nova Scotia. The property is estimated to contain from 50 to 60 million tons of Coal. No Coal Mine can be more easily or cheaply operated. The angle of dip is 6 degrees, and the rock stratification is remarkably even and without fault or break.

Apply to

ALEXANDER CAMPBELL,

Annapolis Royal, N.S.

Handling Rock.—A cubic yard of hard rock in place or before being blasted will weigh about 1.8 tons, or 150 lbs. per cubic foot, if sandstone or conglomerate; if good compact granite, gneiss, limestone or marble, 168 lbs. per cubic foot, or 2.0 tons per cubic yard. A cubic yard of any of these in the solid will, when broken up by blasting, for removal by wheelbarrows or car's, increase 0.8 or 1/3 in bulk, whereas average earth, when loosened, increases to but about 1.2 or 1 1/2 of its original bulk, when in place; although after being made into embankment it eventually sinks into less than its original bulk. In estimating for earth, it is assumed that 1/4 of a cubic yard in place is a fair load for a wheelbarrow. Such a cubic yard will weigh on an average 2,430 lbs., or 1.09 tons. Therefore 2 1/4 x 2,430 or 174 lbs., or 2.31 cubic feet is the weight of a barrow load. Assuming that a barrow of loose rock should weigh about the same as one of earth, we may take it at 1/4 of a cubic yard, which equals 4 1/2 x 36 or 177 lbs. or 2 cubic feet of loose rock. The quarrying of average hard rock requires from 1/4 lb. to 3/8 lb. of powder per cubic yard in place. But the nature of the rock, the position of the strata, etc., etc., may increase it to 1/2 lb. or more. Soft rock frequently requires more powder than hard. A good churn driller will drill from 8 to 12 feet in depth, of holes averaging 2 1/2 feet deep and two inches in diameter, per day, in average hard rock, at from 12 to 18 cts. per foot. A cart load of rock may be taken at 1/3 of a cubic yard in place. This will weigh, on an average, 851 lbs., or but 41 pounds more than a cart load of average soil.

Quartz as an Insulator.—At the Physical Society, recently, in London, Mr. C. V. Boys read a paper on the insulating properties of quartz, which, it appears, are far higher than those of glass, while the former material has the enormous advantage of being practically non-hygroscopic. Since, moreover, the quartz, when once it has been melted, can be worked very much more easily than glass, this discovery of Mr. Boys ought to prove of great value in the construction of electrostatic instruments. Mr. Boys stated that even if the quartz was dipped into ammonia, or boiled in a solution of potash, it only required washing with water to completely restore its insulating properties, and when it was raised to a red heat these properties were recovered on cooling. Some quartz, which the author kept for a considerable time in fused potash, did lose its insulating properties to a certain extent, as was to be expected; but even after this treatment the quartz remained a better insulator than glass.

Removal of Ice in a Down Cast Shaft.

—The ventilating machine used in the coal mines at Zauckerode, in Saxony, send down about 80 cubic metres of air a minute, which, in winter, forms masses of ice near the foot of the shaft. Until recently this formation was removed by the night force with a pick-axe. This was not only a dangerous task but one that presented great difficulty on account of the solid character of the walls of the shafts. Efforts were made to introduce jets of steam, but these only increased the deposits of ice already formed. Recently it was decided to attempt a new system consisting of a number of heated tubes, 70 millimeters in diameter, constructed in such a way as to contain a mixture of steam and air. This method proved a perfect success and the formation of ice was stopped.

ALEX. RANKIN,

20 Toronto Street, Toronto Ont.

Agent for sale of Mines and Mineral Lands.

CORRESPONDENCE SOLICITED.

Agents in England and New York.

E. H. SARGENT & CO.,

IMPORTERS AND DEALERS IN

ASSAYER'S MATERIALS,

Chemicals and Laboratory Supplies.

125 State Street,

CHICAGO.

HARRIS & CAMPBELL

Latest Designs in Drawingroom, Diningroom and Bedroom

FURNITURE

With improved Steam Machinery our facilities for manufacturing Cabinet Goods are complete. Our upholstery Department is well stocked with latest imported patterns.

Corner QUEEN & O'CONNOR Sts.
OTTAWA.

THIS YEAR'S

MYRTLE

CUT AND PLUG

Smoking Tobacco

FINER THAN EVER.

SEE

T & B

In Bronze on Each Plug and Package.

THE DOMINION

SAFETY BOILER CO.

MANUFACTURERS OF

The "Field-Stirling" Patent High Pressure Boiler,

The Safest and Cheapest Steam-Generator now in Use.

This Boiler is unusually durable, being made of the best steel and wrought iron exclusively. No cast-iron is employed. It is simple in construction, has a rapid, well-defined circulation, and a large cool mud-drum, where all impurities are collected to be blown off. All parts of the Boiler are readily accessible for the closest inspection. It has great excess of strength and is not liable to be strained by unequal expansion. The water space is divided into sections so arranged that NO EXPLOSION IS POSSIBLE.

Some of Our Leading Customers:

The J. A. Converse Mfg. Co. (A. W. Morris & Bro.), Montreal; The Canada Sugar Refining Co., Montreal; The Pillow and Hersey Mfg., Montreal; The Berthier Beet Root Sugar Co., Berthier, Que.; The Imperial Insurance Co., Montreal; The Massey Manufacturing Co., Toronto; The Acadia Coal Co. (Ld.), Stellarton, N.S.; Canada Paper Co., Windsor Mills, Que.; Royal Electric Co. (Central Station), Montreal; Dodge Wood Split Pulley Co., Toronto, and a repeat order from A. W. Morris & Bro., after five months' experience; Ingersoll Rock Drill Co. of Canada.

We guarantee Dry Steam and Great Economy of Fuel. Correspondence Solicited.

J. FRASER TORRANCE, M.E.,

P.O. Box 1707, Montreal.

Manager.

The Canadian Mining Review

CONDUCTED BY . . . B. T. A. BELL

OFFICES:

UNION CHAMBERS, 14 Metcalfe St.

OTTAWA.

Vol. VIII.

MAY, 1889.

No. 5.

The White's Asbestos Company.

We hear a good deal of unfavourable comment upon the prospectus of the White's Asbestos Company, a brief summary of which was published in our last issue. Like many other ventures now upon the market the price asked for these undeveloped lots seems to us excessive, while the estimates of production and profit cannot be regarded by those conversant with the industry, and the location of this property, other than extremely visionary. As a matter of information we are curious to know what are "the mines in the immediate neighbourhood of the property which yield an average production of 350 tons per annum," and also upon what grounds Mr. Lucius Boyd bases his estimate of an annual output from *each* of these South Garthby lots "of not less than 350 tons." If this gentleman will put on his spectacles and look carefully at the map of the asbestos region he will be surprised to find how many miles really intervene between his property and the Thetford and other producing mines.

It is the custom, nowadays, of vendors of asbestos lands and quarries to lay a great deal of stress upon the very high figures which are now realized for "*First*," and the profits of the Bell's, and similar successful concerns, are strongly emphasized in their prospectuses as an inducement for investment. It is high time that this fallacy was exploded. A comparison of the statistics of the annual production of Canadian asbestos will show that "*First*" hardly form *one-fourth* part of the general output, while "*Thirds*," which at present it hardly pays to work, constitute at least *one-half*. It would be well, therefore, if promoters would, in their statements to the public, give more prominence to the necessary production of "*Seconds*" and "*Thirds*," instead of basing their estimates of profit *entirely* upon an output of *First* quality as at present. It is also worthy of note, that while the Serpentine area, so far as explored, is extensive, it contains large sections which are utterly barren and worthless for asbestos producing purposes. Investors will find it to their profit to look carefully and cautiously at many of the schemes now upon the market.

The Nature and Origin of Deposits of Phosphate of Lime.

We have before us a Bulletin of great interest to all those in any way interested in phosphate mining, and the uses of phosphate as an agricultural fertilizer. Wheat contains eight

tenths per cent. of phosphoric acid, or about 16 lbs. to the ton, and a very little calculation will show the enormous amount of this actually carried away annually from our land in the large quantity of grain shipped every year from the port of Montreal. The most available source of resupplying this plant food to the soil are concentrated natural deposits, such as Canadian apatite when chemically treated, or in the crude finely pulverized condition. The immediate results from the latter are now a question to be solved by experiment, but whatever conclusion is arrived at, apatite itself is an acknowledged necessity, and that in yearly increasing quantity, which must give an impetus to the phosphate trade.

In the introduction on page 9 of the above Bulletin, by Prof. N. S. Shaler, Boston, the geographical history of phosphate deposits receive considerable attention, and in the main portion of the publication the article on their nature and origin by Dr. R. A. F. Penrose, contains material that will throw much light on the subject generally, and especially on our Canadian phosphate areas. In fact it contains a concise history of really all the known workable deposits in Canada, and copious notes on the same. Dr. Penrose, who is now State Geologist at Austin, Texas, was for several years connected with the Anglo-Canadian Phosphate Company, at Perth, and these investigations were made entirely at his own expense.

We know of no other publication which more clearly describes the whole phosphate country, and all other sources of supply are equally well set forth. The work is, moreover, illustrated with numerous diagrams, showing the veins, pockets and distribution generally in various pits or mines now being worked. Tables of analysis will be found at the end, showing the qualities of ground, and the phosphates of the various countries as analysed are reported in tabular form with their component concomitants. We strongly recommend the perusal of this Bulletin to our readers, and regret that want of space will not allow us to quote in detail from its pages.

It should be mentioned that this report, although designed as a memoir of the U. S. Geological Survey, was used in manuscript form by Dr. Penrose as his thesis for the degree of Doctor of Philosophy at Harvard University.

The Frontenac Mineral Country.

We have been favoured with the full text of an admirable paper by Mr. J. Bawden, read before a recent meeting of the Kingston Board of Trade. Mr. Bawden describes at some length and in an able and interesting manner the various mines and the mineral wealth which form a characteristic feature of the country. In the opening of the paper reference is made to the phosphates of the Township of Longhoro, and to the mines in operation at Bobb's Lake and other sections of the county. It is pointed out with a great deal

of truth that much could be done to further the development of this wealth by macadamizing and improving the country roads, and by the abolition of the tolls on the Perth road over which the greater portion of the mineral has to be hauled. We are glad to see that steps have since been taken to urge the necessity of having these improvements carried out. The mica, plumbago, and the extensive iron deposits are fully described, particular emphasis being laid upon the losses which have been incurred by the ignorant and unsystematic methods of working hitherto pursued by some of the miners. It is pointed out that not only has no attempt been made to call in the aid of scientific and practical engineers in guiding the operations of the diamond drill, but it is the fact that the very cores which have been raised from depths varying from 50 to 300 feet, and which would give evidence of some value, have been scattered indiscriminately among the rocks. Mr. Bawden commends the process of treating iron ores generally adopted in Sweden, whose prominent excellence in this industry is due to the careful preparation of the ore for the furnace, to the purifying influences of charcoal fuel, and to the skill of thoroughly trained and competent engineers. An excellent paper concludes with the following suggestions:

"The rapid destruction of the forest in the Northwestern States should be an incentive to the protection of our own when we see it is the fact that charcoal iron and steel made from charcoal iron heads the price lists the world over. Notwithstanding all the advance of the past ten years no branch of iron and steel manufacturing industry is to-day in a more flourishing condition than that which lives by forest fuel, and it is of the very nature of things that while this fuel is obtainable its greater cost will be fully repaid by the higher price obtained for the iron and steel produced by its aid. The very best service which can be done to the northern settlements of Frontenac is to make the existing forest yield a supply of fuel which at the furnace mouth will be transmitted into one hundred dollars cash by the produce of every acre of woodland."

Another matter of policy I urge you to press upon the government is the withdrawal of all crown land from sale pending the examination proposed. At its conclusion the government will have much valuable information to guide its future policy. A portion of the territory examined might be put up at auction to the highest bidder and good prices obtained for it. Other portions might be granted free on condition that the grantees shall establish furnaces, chemical works or other branches of mining manufacture. In either case the country will be richer by such a policy than by selling mineral land as at present for \$1 an acre—a policy which affords a premium upon speculative holding and is a bar to enterprise.

These suggestions, we are glad to see, have been made the subject of a Memorial to be submitted by the Board of Trade to the Ontario Government.

Canadian Mineral Production in 1888.

The preliminary statistical summary of the mineral production of the Dominion annually published by the Geological Survey has been issued, and is reproduced here for the benefit of our readers. A comparison with the returns of previous years will show that satisfactory progress has been made. The total estimated production is quoted to have been about \$16,500,000, or an increase over the previous year of \$1,500,000, and \$5,970,639 more than in 1886. Of course this statement is still incomplete, and

subject to revision; when full returns have been made we are confident that it will be found that the progress has been even more marked than the summary indicates. The following are the figures which have this year been collected and compiled by Mr. H. P. Brumell:

Name of Product.	Quantity (a).	Value (b).
Antimony ore (exports) tons.	352	\$6,894
Arsenic. " "	30	1,200
Asbestos (c) " "	4,404	255,007
Bricks " " thousands.	165,265	1,033,721
Building stone " " c.yd.	387,164	561,197
Cement " " bbls.	50,668	35,593
Charcoal " " bush.	233,648	15,703
Coal " " tons.	2,658,134	5,259,832
Coke (d) " " "	45,373	134,181
Copper (e) " " lbs.	5,562,864	667,543
Fertilizers " " tons.	548	21,600
Glass " " "		150,000
Gold (f) " " ozs.	58,957	1,058,610
Granite " " tons.	19,172	63,846
Graphite " " "	150	1,200
Grindstones " " "	4,936	42,159
Gypsum (g) " " "	175,887	179,393
Iron (h) " " "	40,962	1,442,974
Iron ore " " "	44,410	139,393
Lead (fine, contained in ore) " " lbs.	674,500	27,472
Lime " " bush.	2,213,464	339,541
Limestone for iron flux " " tons.	15,577	14,742
Manganese ore (i) " " "	1,782	47,243
Marble and Serpentine " " "	215	3,110
Mica " " lbs.	29,025	30,207
Mineral Paints " " gals.	1,497	11,750
Mineral Water " " tons.	124,850	11,456
Miscellaneous clay products " " "		350,370
Petroleum (j) " " bbls.	695,200	716,057
Phosphate (r) " " tons.	22,485	242,285
Pig Iron " " "	18,191	226,443
Platinum " " ozs.	1,200	4,800
Pyrites " " tons.	51,764	232,938
Salt " " "	44,581	143,804
Sand and gravel (exports) " " "	260,929	38,398
Silver (l) " " "		368,396
Slate " " tons.	5,314	90,689
Soapstone " " "	140	280
Steel " " "	9,508	470,819
Sulphuric acid " " lbs.	7,143,210	97,755
Tiles " " thousands.	7,518	114,057
Whiting " " tons.	200	240
Estimated value of mineral products not returned (principally rolled iron and glass) " " "		1,847,102
Total " " "		\$16,500,000

(a) Quantity marketed, except when otherwise specified. The tons are of 2,000 lbs.

(b) Market value, less charges of transport from point of production.

(c) There was no production from Ontario this year, but there was an increase of 185 tons from the mines of the Eastern Townships.

(d) Oven coke; all the production of N. S.

(e) Copper contents of Capelton ores at 12 cts. per lb. at the mine.

(f) Nova Scotia gold is calculated at \$19.50 per oz., and that from British Columbia at \$17.00.

(g) Production of New Brunswick and Ontario, plus Nova Scotia exports.

(h) This includes four rolling mills, one forge and the London-derry Iron Works returns have no yet been received from six similar works, thus rendering this statement very incomplete. The total manufactures of iron will, however, be much larger than those of last year.

(i) New Brunswick production plus Nova Scotia exports.

(j) These figures are calculated from the inspection returns at 38 galls, crude for 38 galls, refined oil, and are computed at \$1.03 per bbl. of 35 Imp. galls. The barrel of refined oil inspected was assumed to be 42 Imp. galls.

(k) Direct returns. The production is divided as follows:—

Ottawa County mines..... 20,336 tons,
Ontario mines..... 2,089 "

Total..... 22,425

The exports as per Customs Department returns were 18,776 tons valued at \$3,981,609.

(l) Exports plus silver contained in Capelton ores. Some returns yet to be received.

The Late Hon. Robert Dunsmuir.

General sorrow and regret has been caused by the sudden demise of the Hon. Robert Dunsmuir, president of the Council of British Columbia and owner of the Wellington and other extensive collieries in that province. He was born in Hurlford, Ayrshire, Scotland, in August, 1826, and was therefore in his 63rd year. He was the son of Mr. James Dunsmuir, a proprietor of coal mines in that locality, but being early left an orphan was brought up by his uncle, Mr. Boyd Gilmour, with whom he came to British Columbia in 1851. Mr. Gilmour was employed by the Hudson's Bay Company to prospect and open up mines for them on Vancouver Island, which resulted in the discovery of the collieries now owned and operated by the Vancouver Coal Company (Limited). On Mr. Gilmour's return to Scotland in 1853, Mr. Dunsmuir was left sole manager of the mines and continued to fill that position for many years to the satisfaction of the company. In 1865 he was induced to accept the management of the Hanwood coal mines, in the same locality, but as they did not turn out satisfactorily Mr. Dunsmuir shortly afterwards resigned and went prospecting on his own account. After spending some five years at this work he was at length rewarded by the discovery of the now celebrated Wellington collieries, from the judicious management of which he laid the foundation of the great wealth of which he was possessed when death put an end to his useful career. Mr. Dunsmuir was also the original promoter, as well as manager and principal owner, of the Vancouver Island Railway. At the time of his death he was engaged in opening up the valuable Union collieries in the Comox Valley, about 65 miles to the north of the Wellington mines. In connection with the above, Mr. Dunsmuir gave employment to nearly 2,000 men, and was also owner of a fleet of sailing vessels and steamships, representing many thousands of tonnage for the coal carrying business, for which his principal markets were San Francisco, Wilmington, the Sandwich Islands and China. Mr. Dunsmuir was elected to the Local Legislature for Nanaimo in 1882, and has held the seat for this constituency ever since. He was a man of great enterprise and business capacity, and combined with an iron will and indomitable determination and perseverance a most kindly and charitable disposition. His death has created a void in British Columbia which it will be very difficult to fill.

A Useful Handbook.—We have received from the Rand Drill Co., 23 Park Place, New York, a copy of their catalogue for 1889. This volume consists of some 200 pages profusely illustrated with the latest and most approved designs in drills, air compressors, air receivers, pumps and mine machinery and supplies of every description. It also contains a large amount of useful information pertaining to the drilling and excavating of ore and rock, and is well worthy of the perusal of all our readers.

LETTERS TO THE EDITOR.

Facts and Mineral Development.

The Editor

THE CANADIAN MINING REVIEW:

SIR—I feel sure that everyone who is interested in the legitimate development of our mineral wealth has read the first article in your April issue (viz., "Our Libel Suit") with much pleasure. We have long needed some independent mining organ which was strong and popular enough to make itself felt, and which would state facts without fear or favor. It is impossible to overestimate the great amount of good such an organ can accomplish if it fearlessly adopts the plan of complete independence.

The thanks of those of us who wish legitimate mining to flourish in Canada as a business and not merely as a speculative game, are due to you for the admirable stand you have taken.

I must hasten to say that so far as the matter under dispute between Mr. Lionais and yourself is concerned, namely, whether a certain property justifies certain expenditures, I know nothing whatever about it. Your warning to investors against confusing "mining locations" for "mines" is of primary importance. The term "mine" has been altogether too loosely used in this country; its definition as a place where mineral is wrought by means of artificial light is lost sight of, and even our Ontario mining law describes "a mining location" as a "mine." This we may hope will soon be rectified.

Yours, etc.,

WM. HAMILTON MERRITT.

Toronto, 15th May, 1889.

Iron in Ontario.

The Editor

THE CANADIAN MINING REVIEW:

SIR—Mr. Charles S. Burt, until lately superintendent of the Detroit Furnace Co., is now visiting the iron districts of Ontario with the view of investigating the inducements for erecting a charcoal blast furnace, and it is to be hoped that he will find a situation sufficiently favorable for the purpose.

Over 180,000 tons of Charcoal pig iron were smelted in Michigan during the year 1887, while Ontario with equally as good localities has not a single furnace in operation; so there certainly should be a good opening for this important industry.

We have plenty of ores suitable for making Charcoal iron, which are distributed over a wide area, in some instances being conveniently situated to railway or navigation, with plenty of charcoal and flux within easy distance.

The Irondale, Bancroft and Ottawa Railway, running eastward from the Haliburton branch of the Grand Trunk, passes through the Township of Snowden, in which are several deposits of ore suitable for charcoal iron. These are veins of magnetic ore close to this railway containing from 55 to 63 per cent. metallic iron with very little phosphorus and no titanium. In the same neighbourhood are also found beds of limonite or brown hematite, which would mix well with the richer magnetites.

The Largest Crane in the World—

At the Chatham dockyard there has been a test by the Admiralty of the largest and most powerful crane ever made. The weight lifted was 240 tons, and the range or radius of the crane is 75 feet 3 inches, and its height is 125 feet.

On the lines of the Central Ontario Railway and of the Kingston and Pembroke Railway are several large deposits of ore in the midst of well wooded districts, where charcoal can be obtained as cheaply as almost any place on the continent.

Situated in Lake Nipissing is Iron Island, containing a wonderfully pure red hematite, of which Professor Chapman has made an analysis showing metallic iron 65%; phosphorous, faint trace; sulphur, faintest trace; titanium, none.

Round the shores of this lake are large tracts of hardwood suitable for charcoal. North Bay, the junction of the C. P. R. with the Grand Trunk, should be a good point for a furnace, to which both charcoal and ore would have easy access.

Then on the shores of the Georgian Bay good ore is found. A mixture of magnetic and specular ore from the neighbourhood of Killarney has been analyzed by Dr. Chapman, showing metallic iron, 60.85; phosphoric acid, faint trace; sulphur, 0.04; titanium, none; silica, 7.64. This mine is close to the shore and is excellently situated for a furnace, as it is directly in the line of travel, and charcoal could be carried to it conveniently from any part of the coast. Or this ore could be shipped direct to Cleveland or other ports by water without the expense of any railway carriage.

Yours, etc.,

T. D. LEDYARD.

Toronto, May 15, 1889.

The Promotion of Mining Companies.

To the Editor:

THE CANADIAN MINING REVIEW:

OTTAWA, 18TH MAY, 1889.

SIR,—When there chances to be demand for an ore or mineral, in excess of the supply of the article, or, as the saying goes, if there is a "boom" in a metallic or non-metallic mineral, it seems in Canada to be a necessary accompaniment of the system of individual ownership of minerals, for gentlemen of large legal ability, to enter into the business of promoting mining schemes. This custom, by lawyers of legal, political and appropriative ability, has been carried on to such an extent as to be now, unfortunately, a too prominent feature in the industry, and of the failures of late years. In too many cases has this been proved, in the non-dividend paying qualities of the enterprises which they promote. Can dividends be expected when the purchase price is excessive, or beyond the actual capacity of the property, or necessary condition of ore in sight ready for stopping or mining? Mr. Lawyer promoter is interested purely in the "sell" question of the enterprise, and the "output of the mine," and "income in relation to capital," are secondary considerations to him and are relegated to the management of the company. The lawyer promoter does not hold himself responsible for excess of capital over the item of profits of working the mine. These legal gentlemen are highly protected by law from competition, in the courtly and just industry of "what is mine" by law, and the taxed account of court. So they enter the field of the mining engineer, armed with a large acreage of the so-called mining lands, more or less developed, and held in fee simple or in bond. This they desire to dispose of at very high figures, and if they succeed in doing so "according to legal principles," the manager, who usually is called in after the sale has been made, is held responsible for the success or paying qualities of this legally produced mining venture. Capital has then to appeal to the courts of justice. If the public press are found bold enough

to show up the actions of legal gentlemen, in such matters as not min(d)ing their own business, they have also to fight these lawmakers and legally capable "boomers" in actions for libel. In countries where the miners have rights, and where under good laws their rights are granted to them (such as the right to trade in their own calling or business), and where the laws allow them to exercise the at present liberal principle of "free trade" within their own province, we find the mining industry prospers. In countries where development and work are made conditions of tenure of mining claims, we find there is no chance for this legal parasitical growth. It ought to be the policy of a mining journal to protect labour engaged in, and capital invested, or about to be invested in the mining industries of the country; hence, your appropriate remarks in former numbers. Legally disposed gentlemen will have to re-write history to prove it otherwise.

Yours, etc.,

JOHN STEWART.

Amalgamation.

By B. C. Wilson, President Gold Miners' Association of Nova Scotia.

In the early days of California gold mining, amalgamation was an unknown term, and quicksilver and amalgam unknown quantities. We washed away the auriferous sands and got the golden grains in their original and yellow purity. Bye-and-bye some of the large sluicing and hydraulic companies introduced quicksilver, and it was soon in general use, but being very crudely handled immense quantities were washed away with the debris, and if quicksilver can do it, certainly the whole state of California should be thoroughly salivated.

When quartz crushing was inaugurated in Nova Scotia the quicksilver and gold were not introduced to each other until after the ore was crushed, and not during the process of reduction; consequently the present system of copper plates was unknown, but the crushed sand was washed over riffles and pools of quicksilver arranged according to the ingenuity of the experimenters in various tempting ways to inveigle the gold into a new home, and it was not considered inconsistent to employ 100 pounds of quicksilver per battery of four stamps.

I think the first person to introduce quicksilver amalgamation to crushed ores in Nova Scotia was the late Charles Puttner, of Bavaria, who came here from Carolina at the instance of the late Joseph Wier, and set up an experimental Chilian mill at Freshwater, Halifax.

If I am not in error, I started the third stamp mill in Nova Scotia, making all the patterns myself and invented, without knowing it, the present style of stamp head and method of attaching it to rod. Our venture was a joint stock affair owned in Halifax, and the directors deemed it their duty to do a great amount of detail directing on matters of which they were perfectly ignorant, and in the light of present improvements I was not much better, and I got a decided reprimand for putting in round stamps instead of square ones, and learning that I entertained certain hectical ideas of putting mercury in the mortar while the ore was being reduced they took early precaution to direct me "not to do it" under penalty of their severest displeasure.

We crushed three weeks without quicksilver, other than in riffles and in sluices; and finding particles of unamalgamated gold going off in the tailings, I then without the knowledge of any one, charged one battery with quicksilver and ran the other without. The result of the

week's work was 25 per cent more gold in the quicksilver mortar than in the other—next week I changed the quicksilver to the other mortar and ran the first without, with just about the same results in favour of the one with mercury in it. I followed this up for four weeks to thoroughly satisfy myself and then reported to the directors, who kindly directed me to use my own judgment in the matter.

This innovation called the copper plates into existence. At first they were very small and very thin; later on we got thicker ones, and made wide at the top and narrow at the bottom like the inverted gable of a house, and, so enduring are early impressions that I regret to say many persons who consider themselves authorities on this subject still adhere to this form of plate. It requires, however, but little demonstration to show the fallacy of the principle; whatever increases the quantity of water or pulp on any part of the plate disturbs the adjustment to an extent which makes either one or the other part inoperative as a saving appliance.

More recently a copper plate with an electro deposition of silver on one surface (more popularly known as "silver plate") have been introduced. My own experience with these extends over only half a year or so, but I am free to record my appreciation of them, as they always present a clean amalgamated surface from the word "go," which cannot be permanently obtained on a copper plate until there is on it an amount of amalgam equal to about two ounces of gold per square foot, which must be kept there as long as you expect the plate to be efficient, though, of course, you can get it all back when the plate has outlived its usefulness (provided the temptation offered has not induced some one to rob you of them in the meantime), while on a silver plate the permanent accumulation of gold seems to be practically inappreciable, so that, all things considered, the silver plate is both an economy and a security.

There seems to prevail an idea that any gold once attached to an amalgamated plate is practically saved. This I have lived to know, is an expensive fallacy, and one which I believe to be largely increased on the silver plate as compared with the copper one, and I deem it very important to provide means to intercept the slow glacier-like progress of amalgam which commences an almost imperceptible journey down and eventually over the plates and out of the mill.

It is an acknowledged axiom that the best thing to catch and retain gold is gold amalgam itself; and it is familiar to mill men that a plate roughly coated with beds or ridges of amalgam is the best thing to have your gold fall on as it comes from the stamps, but this is a condition of things not always possible or convenient to maintain, and, even if it were, small particles of gold, either owing to their ragged form presenting an increased surface to the flowing water, or from some other cause seeming to have less specific gravity, will keep working away from the main mass and along down the plates, aided, no doubt, by the small quantities of mercury draining from the amalgam as well as that continuously supplied from the mortars, which mercury too, always carries some fine gold with it—and together they eventually pass off the plates, resulting in very considerable loss.

Various methods are adopted in every mill to intercept these fugitives, the more familiar of which used to be:

1st. Shaking tables, which I might characterize as wolves in sheep's clothing; they have gone out of practice, however.

2nd (and what is in most general use at the present day), boxes, pools or trays containing more or less mercury as a nucleus into which the whole current is precipitated and where, it is fondly hoped, any truant particles will be induced to remain. My experience with these has been that they serve to relieve the conscience or the incompetence of the architect and the mill man, hoodwink the owner or the capitalist, and pass along to the bank of tailings, about all the gold that ever comes into them.

3rd. Riffles and blankets at the tail of the plates with facilities for catching and retaining particles of mercury, gold and the denser sulphurets. Riffles cannot be objected to if too much confidence is not placed in them. They are not human, but nearly as unreliable. Blankets are unquestionably of service, particularly if no other system of concentration is employed, and though they take a great deal of attention they undoubtedly save much valuable material for further treatment, and it is simply a question of condition of ore and capacity of mill whether it will pay to keep a man specially employed at them or not. In many mills of even small capacity I have found an official known as an "amalgamator," whose duty seems largely to be to stand and serenely listen to the hammering of the stamps, and it might in such cases be very profitable to employ blankets and let him attend to them, which besides the monetary benefits resulting, would also largely relieve the devil of finding employment for otherwise idle hands.

To prevent the loss of mercury and floating gold I believe the first principle is to afford reservoirs or deposits of mercury in connection with the plates, but under no consideration to allow such a flow or fall of the pulp as will disturb or break the surface of the mercury, and yet have these reservoirs so constructed that their shall be no accumulation of pulp or sulphurets upon the surface of the quicksilver.

There is an arrangement of the copper plate which I have found most efficient in arresting the truant particles of gold and mercury before referred to, but the arrangement is so simple that it does not generally recommend itself; also the correct adjustment lies within such narrow limits between success and failure, through impatience and neglect to investigate the cause of results, that parties are apt to "damn the arrangement" when a little more attention would have demonstrated its usefulness.

When properly adjusted it is self-acting, needing no attention, and is always in order, and consists of peculiar curved troughs formed at the lower end of each copper which allow the water and pulp to flow down the curve—not to fall—and which have sufficient elevation at the bottom to form a shallow reservoir the whole width of the plate, but with not sufficient obstacle to admit of the accumulation of sulphurets or heavy particles.

Some believe in a long sheet amalgamated plate—sometimes as long as twelve feet—my experience is, that no individual plate need, or should be, more than thirty inches long or thirty-six inches at most, that as many of these plates should be placed below each battery as circumstances or the will of the owner may consider necessary. I would suggest three as ample but there is no great danger of having too many.

As usually laid down the plates present a plain even surface from top to bottom and then perhaps a precipitate fall of one to three inches into another plate, or a series of plates. Now the plan I have mentioned locates at the bottom of each plate this peculiar curved trough which at starting may be charged with

about one pound of mercury. As work goes on the mercury is always increasing and possibly some will have to be removed before cleaning up day. Now if just the right fall and slope and rise at the foot has been obtained the down coming water will follow the curve and impinge against the quicksilver at the bottom and keep a clean mercurial surface ready to absorb all light gold or particles of mercury, and as this surface is never broken it follows that no pieces of amalgam can become detached and wash away after once attached, while the small obstruction at the foot causes the waters to curl back on itself but does not afford sufficient lodgment for sulphurets to block the current and cover the mercury, and thus derange the operation.

Now as to practical results—after a week's running on fairly good ore with the copper plates kept in good order, I have had in the first one of these troughs a ridge of amalgam from one-eighth to one quarter inch deep, an inch or so wide, and four feet long (the width of the plate) and over $1\frac{1}{2}$ pounds of mercury, all, or very nearly all of which I have reason to believe would have been lost under the ordinary process of straight plates and falls and traps.

As before stated their efficiency depends altogether in getting just the right adjustment proportionate to the fall and amount of water used, which is simply a matter of experimental testing and requiring a little patience.

Now all this applies strictly to the copper plates, after them may follow all the other devices desired but it will be found that their occupation will be gone to a large extent.

There has been and I suppose always will be, some loss of mercury through being floured and otherwise, but I am led to believe there are erroneous ideas abroad in regard to floured mercury and what it really is. Technically it is mercury divided into such minute particles that individually they are not visible to the unassisted eye. It is only when a number of them are together that they are readily visible as a white film along the edge of the palm, and I am of the opinion that the actual preventable loss from this source is very small, and the gold carried with it still less; but there is a very appreciable loss of mercury in most mills in particles or little globules readily visible, one of which will contain as much mercury as twenty or a hundred of the floured kind. These all carry more or less gold, and it is to the saving of these that the trough in the plates before described will be found particularly applicable—gravity naturally keeps them near the bottom that is next the plate, and when impinged by the current against the clean surface of mercury in the troughs a majority of them will be arrested, while if allowed to fall into boxes or receptacles of mercury, more or less covered with heavy sulphurets and with an accumulated force of water, but very few of them are retained.

In the falling of the pulp from the mortars to the plates and from one plate to another, that is the "splash," more care to have the same uniform, and occasionally the distribution changed or distributed, should be exercised than is sometimes given it. It often happens from the wearing down of a die or a shoe or some variation in drop of one stamp in a mortar that a greater quantity of water and crushed material is thrown out on one part of the plate than another, with the result that the accumulated amalgam is worn off the plate in one particular spot, even the electro-deposited silver I have seen so worn off, and the red copper showing up destitute of any amalgam or quicksilver, and my experience is that amalgam as worn off from any particular part of the plate, is more difficult

to save than new amalgam falling from the stamps. Sometimes a wire screen or perforated sheet iron is interposed in the fall from plate to plate; the flow is thus broken and the distribution accomplished; but for greater security where such are used it is desirable that they be arranged so that a slight change if only one-eighth of an inch can be made every hour.

In all the foregoing I have referred exclusively to the amalgamation and arresting of the free gold after it has been liberated from the matrix. That much gold still remains in the crushed ore in the shape of gold both mechanically and chemically combined, and which is run off and lost, is, I think, a fact patent to all. This is more a question of concentration and after treatment than of amalgamation, and is one which should engage the earnest attention of every one interested in the gold industries of the province, but in the meantime it is important to give every attention to the perfection of such processes as we have in use and to general mill treatment. Too much honest and legitimate attention by the responsible man in the mill cannot be given to his amalgamation processes, whatever their form, and to seeing that the crushing machinery is performing its duty properly and uniformly, for no irregularity can exist without affecting the whole matter of crushing, amalgamating and retaining the ore.

The Natural History of Coal.

(Contributed by Francis D. Taylor, M.E., Brockville.)

[Continued from April Issue.]

Imagine this process repeated as many times as there are coal seams in a district, and it conveys the most accurate and correct opinion that can be found of the way in which coal and coal strata was deposited.

In some coal fields there are (at least) 50 seams of greater and less thickness, all of which were produced in the way described. And the question is now forced upon the mind, how long did this vast accumulation of vegetable matter, and these siliceous and aluminous shales take to deposit?

Mr. McLaren, a Scotch geologist, who in his *Geology of Fife*, says as the result of a train of elaborate reasoning, founded upon ascertained facts. That every coal seam 3 feet thick, must have taken at least 1,000 years to form; and that the whole of the coal strata, with its many seams, must have taken between three and four millions of years to form.

The mind would be entirely baffled and confounded in connection with such periods did we not consider "That one day is with the Lord as a thousand years, and a thousand years as one day."

In order to make this matter still more clear it will be remembered that the coal strata in Wales is from 10 to 12,000 feet thick, and in the theory propounded there must have been a gradual sinking or depression of strata equal to that extent.

Mont Blanc is about 15,000 feet in height, and the gradual depression therefore of the Welch coal field must have been nearly equal to the present elevation of Mont Blanc.

There are one or two other points to refer to before quitting this part of this subject, and first, as to the kind of atmosphere that must have existed at the time of the coal formation.

It is probable that there was a much larger proportion of carbonic acid in the air than there is at present, and that as the result of this, vegetation grew at a much more rapid rate.

There is no evidence that the growth was very much more rapid than it now is, as some

have supposed, but still the effect of a larger proportion of carbonic acid in the air would doubtless be to produce a more rapid growth than we have now.

The proportion of carbonic acid in the air at present is $\frac{1}{2500}$ part of its volume, and one of the principal reasons why Providence has given foliage to trees is to enable them to collect from the air this gas which forms so important a portion of the food in which they live.

It is the opinion of many that the carboniferous era helped to absorb a large portion of the carbonic acid from the air, and by that means left it more fit for the reptile and mammaliferous developments of life that soon after came upon the stage, and that thus each succeeding geological age has helped to prepare the world to become a fit habitation for man, who is (as this world is concerned) the noblest work of God.

Second—The temperature in which most of the vegetation grew, which forms our coal deposits, must have been at least equal to our tropical climates, and could not have been less than 75° , as nearly all the plants found in the coal shales are among the class that are only found in tropical climates, where this temperature exists.

This brings out another question of great importance and difficulty, viz.: The existence of coal within the arctic circle, proving that even there the temperature was once high.

This has been accounted for by some men of eminence and science on the supposition that the plane or angle at which our planet now revolves has been altered, and instead of its revolving, as it now does at an angle of 25° , it revolved in almost an upright form. The effect of which would, of course, be to equalize the temperature all over the globe.

Astronomers inform us that is the way in which Jupiter at present revolves round the sun, so that it is not at all out of the range of probability that the opinion relative to the former position of our earth is correct.

And now to the third part of this subject, viz.: The present position of our coal beds and the changes to which they have been subjected.

This is a large and important subject, upon which there is not time to fully enlarge upon, and includes:

First—The chemical changes which coal has undergone since its deposition.

It is singularly interesting to trace the gradual chemical changes to which coal has been subjected in its various stages, from vegetable fibre to its present compact form, and it is equally interesting to know that those changes have not destroyed the chemical affinity of coal to vegetable life.

By the aid of chemical analysis we learn that the same elements may be obtained from coal as are found in vegetable life, the main difference being that they are combined in different proportions, and strange as it may seem, the diamond is composed of the same constituents that constitute nearly the whole substance of our coal, namely, carbon. Yes, the diamond is composed of the same elements as coal, and is the result of the decay and crystallization of carbon.

If burnt, it takes the same amount of oxygen as charcoal, and gives off the same volume of carbonic acid, and melts at 14° less temperature than silver.

Second—Another most important subject that comes under this head is the question of faults, or the subsequent dislocation, upheavals and depressions to which the coal strata has been subjected.

Though coal was found as described in a com-

paratively tranquil state of the world. It has been very roughly handled since then by nature.

There is hardly a coal field in the world but shows evidence of the disturbance and agitation that has taken place since its formation.

These faults sometimes throw the strata up or down for several hundred yards, and are to be found at all angles and of all sizes, proving the truth of those sublime words of one of the earliest geologists of whom we have an account. The old patriarch Uz, who said: "He putteth forth His hands upon the rock and overturneth the mountains by the roots (Job xxviii, 9)."

There are one or two laws relating to faults worth knowing:

First—That the largest and strongest faults generally run north and south.

This rule, however, is not entirely without exceptions, but it may generally be relied on.

Second—By observing the angle of the cheek or face of the fault, it is possible (nearly always) to tell whether the coal is thrown up or down, and for want of knowing this simple law thousands of pounds sterling have been lost in mining.

Third—As regards the present position of our coal seams.

It is known that coal lies at all depths from the surface, and that in some cases it is worked at the surface of the ground, like the open-top workings of the thick (or 10-yard) coal of South Staffordshire. At other places it is worked nearly 1,000 yards below the surface, as at the Dunkensfield colliery near Manchester.

During the early stages of coal mining, when the mechanical power for winding coal was limited to the hand-reel and the horse-gin, of course the operations of coal mining were of the most primitive character, and had to be carried out on the most limited scale.

At present one-half mile below the surface seems to be about our maximum limit for mining.

At present the greatest obstacle to going depths is not the lack of mechanical powers to draw the coal (we can supply that), but we want some means either mechanical or chemical of neutralizing the increased temperature of great depths. The temperature appears to increase to the extent of about 1° for every 50 or 60, or say 5° for every 100 yards. And at this rate the temperature at 500 yards deep would be 25° greater than at the surface, and in practice this is found to be the case.

Can this difficulty be got over is the question, and it is one to which our best men of science will, it is hoped, devote time, attention and thought.

That man will indeed be a benefactor of his species, who can contrive some means of lessening the temperature of deep mines.

What a blessing it is, however, that even with our present appliances so much of this useful mineral is within our reach.

Fourthly—One or two general and miscellaneous points.

First—The importance of skill in raising our coal so as not to waste what has been so benevolently and graciously provided.

A bed of coal usually produces about 1,200 tons to the acre per foot thick, but less than half that quantity is brought in some instances to the surface and sold in consequence of the waste and unnecessary loss in working it.

The introduction of the "long wall" system of working coal has benefitted the output in some cases 30 per cent. or more, and much credit is due to Mr. Moses Taylor, mining engineer, for introducing this system and adapting it to the working of the 10-yard coal in South Staffordshire.

Again the conversion of the small coal into patent fuel has done much to improve the system of working, and to economize the produce of mines. But much more has to be done yet.

Second—The adoption of wise and proper means to ensure the safety of those who are engaged in this most important branch of national industry seems naturally to grow out of what has been said.

If coal is valuable, the lives, health and happiness of those engaged in mining is more valuable still, and we are called upon by every consideration of humanity, self-interest and national honor to use every possible means to insure safety in working mines, and certain it is, that safety and economy will be found to be synonymous terms in relation to mining.

Third—The importance of a correct knowledge of the structure of the earth is suggested by this subject. Without this it is difficult to know where to look for the minerals, or metals, which are locked up in the secret recesses of nature, and which she only opens and makes known to those who have knowledge sufficient to read her language and decipher the hard writing on her rocks.

The geologist by means of carefully looking at this hard writing is able to direct the practical miner where to sink and how to act, and thus science and practice unite to promote human happiness and the material greatness of the world.

Fourth—The wonderful way in which God has arranged and adapted the earth to provide for man's wants, is suggested by the "Natural History of Coal."

Tell me what we want that the earth will not supply?

Its surface provides food of every kind, and in great abundance; fruits and flowers to please the taste and gladden the eyes.

The rocks yield our metals, and the seams of coal furnish us with fuel.

Well may the inspired "Psalmist" say: "He opens His hands and satisfies our wants."

And that heart must be cold and hard that can look upon all that God has done for the happiness of his creatures, and not exclaim, "Great and marvellous are Thy works Lord God Almighty."

Gypsum Deposits in Northern Manitoba*

J. B. TYRRELL, B. A., F. G. S.

On the Little Saskatchewan River, which carries the overflow of Lake Manitoba into the western side of Lake Winnipeg, there is a comparatively small shallow lake which has been known since the time of the early voyageurs as Lake St. Martin. It lies in latitude, $51^{\circ} 30'$, longitude, $98^{\circ} 46'$, has an area of 115 square miles, a greatest depth of about fifteen feet, and an approximate elevation above the sea of 790 feet.

Lying to the north-west of this lake, there is an area of level or very gently sloping country, which is now covered by extensive natural meadows, separated by groves of poplar and birch, as well as occasional forests of spruce and tamarac. This country is as yet in its native beauty, being entirely untouched, either by the woodman's axe or the plough of the farmer; but the time cannot be far distant when a thriving agricultural population will occupy the district, reaping from the fertile soil bountiful and continuous harvests.

In the early part of the past summer, the writer made a short journey on foot into this country, from the shore of the lake, in order to determine the question of the existence or non-existence of beds of gypsum in the vicinity.

Starting from the north-west corner of the Indian Reserve at present held by the Saskatchewan Band of Saulteaux Indians, we travelled in a general north-westerly direction for five miles, till we reached a rounded gravel ridge, rising from fifteen to twenty feet above the general level of the country to the northwest of it, and along the foot of which, on the alluvial plain, are scattered numbers of rounded, weather-worn, gneissoid erratics. This ridge represents a beach of the extended Lake Winnipeg, called by Mr. Warren Upham, Lake Agassiz, when it covered the whole of this area, and when the surrounding fertile alluvial deposits were being laid down near its gradually receding shore. The height of this ridge, as shown by aneroids read simultaneously on it and on the lake, is about 840 feet, being fifty feet above Lake St. Martin, and thirty feet above Lake Manitoba. Its chief interest, however, did not centre in the fact that it had once represented a lake shore line, for these shore-lines are very commonly to be met with in all this apparently level Manitoba plain, but that in little holes and caves in it were to be seen small exposures of soft, compact, snow-white gypsum.

Following the ridge, still in a north-westerly direction, for a mile, the surface becomes very rugged and irregular, being broken by deep pits with steeply sloping sides. In this rough country, gypsum may be seen in numerous outcrops, being usually soft and crumbling from the effect of weathering, but in some cases it is still quite hard. The height of the tops of the knolls in this hilly area is about thirty-five feet above the eastern level plain, or sixty feet above Lake St. Martin. The breadth of the hilly country was not determined, but an Indian who accompanied us stated that it extended in a south-westerly direction as far as a certain point on our journey of that day, which was about a mile and a half distant from where we were then standing, beyond which the level country began again.

In a north-westerly direction the ridge was followed for two miles further, to a rather conspicuous hill a short distance north of the Ninth Base Line in section 2, township 33, range 9, west of the Principal Meridian. In this distance it appeared to be broken through by considerable gaps in several places, but where it was well marked it invariably showed the irregular surface so characteristic of country underlain by gypsum deposits. In many places, small caves would extend in from the bottoms or sides of the pits, some of which held beautifully clear, cold water, a luxury of which we were able to appreciate the value, after tramping for the greater part of a sweltering July day through meadows, forests and swamps, where the mosquitoes and black flies did not attempt to treat us any the more tenderly because we were strangers.

This country is a famous winter hunting-ground for the Indians, for in the autumn the bears retire to these caves, as being comfortable quarters in which to pass the time until the following spring, and many of them are killed every year. Around the mouths of several of the caves could be seen marks of the axe, where the hunter had been obliged to widen the entrances to the caves to be able to get into it to secure his prey. The thickness of the exposures of gypsum in these holes and caves was nowhere very great, ranging as a rule from three

feet to six feet six inches, but in none of them was the total thickness of the deposit seen.

The hill at the furthest point to which the ridge was followed, rises as a rounded knob, twenty feet above its general level. This hill, like the others, appears to be composed of gypsum, as on its sides are holes extending down twenty feet below its top in which beds of gypsum are well exposed.

In the north-west corner of township 32, range 8, west of the Principal Meridian, is a rounded hill rising thirty-five feet above the plain, its greatest length being about 600 feet, and its greatest breadth 150 feet. Its surface is overgrown with small canoe-birch. Two holes, each about eight feet deep, have been dug by prospectors in this hill. One at the top shows, below a foot of decomposed material, seven feet of hard, compact, white anhydrite or "bull plaster," exhibiting a more or less nodular structure, and breaking on the surface into small irregular fragments. Very little bedding can be detected in the mass. The other hole is in the side of the hill fifteen feet lower down, and shows on top two and a half feet of white clay, consisting of decomposed anhydrite, below which is five and a half feet of white nodular anhydrite similar to that in the other hole. This gives a thickness, almost certainly, of twenty-two feet of this rock, and it is not improbable that the hill is composed entirely of it.

Again, just north of the Ninth Base Line, and two miles east of the township corner, between Ranges 8 and 9, is a poplar-covered hill or ridge, thirty feet high. In various places on this hill are exposures of snow-white gypsum, similar to what has been described above, showing in some cases a thickness of ten feet in one section. The most of it is massive or cryptocrystalline, and lies in regular beds which dip slightly towards the west. Some of the beds or layers, however, consist of beautifully crystalline, clear, colourless selenite, which is easily broken out in lamellar masses of considerable size. This is the mineral which in the west, has been so often mistaken for mica.

The above is a brief statement of the known extent of the deposits of gypsum in this district, but it is highly probable that further investigation will prove them to extend over a much larger area. The Indians of the Saskatchewan Band, who live on the western shore of Lake St. Martin, informed me that similar rock was to be found in several places further north, and they have named a lake on a tributary of Warpath River, which flows into Lake Winnipeg north of the mouth of the Little Saskatchewan, Ka-ka-wusk Sa-ka-higan (translated in English as Mica Lake) from the alleged presence of selenite in its vicinity.

Towards the south-west, at a distance of 90 miles in a straight line, in the bore that was sunk on the bank of Vermilion River by the Manitoba Oil Company, a bed of gypsum 15 feet in thickness was struck between 550 and 565 feet, at approximately the same geological horizon as that of the gypsum beds above described. Gypsum deposits are therefore in all probability very widely distributed throughout Northern Manitoba.

As far as examined they preserve a pretty constant character. Where they immediately underlie the surface the country is very rough and hilly, and the prevailing poplar of the region is mixed with birch, or the spruce of the adjoining low-lying land is replaced by Banksian pine. The gypsum itself is generally very pure, of a dead white color, and usually stratified in rather thin beds, which are either horizontal or dipping at a low angle. Among the massive beds, however, are many others, com-

posed of crystals or crystal-masses, in which the crystals usually stand transverse to the plains of bedding. Some plates could doubtless be obtained from the crystal-masses sufficiently clear for optical purposes. No anhydrite was seen mixed with the gypsum, but one of the hills, as above stated, appeared to be composed entirely of it. It is much harder and tougher than the gypsum or hydrated sulphate of lime, is considerably heavier, has a roughly nodular, rather than a distinctly stratified structure, and is of a decidedly bluish tint.

Of the exact geological age of the deposit it is difficult to speak as yet with certainty, as the strata have not been continuously traced into any others, and no beds immediately under or overlying them have been seen. There is little doubt, however, that they occupy either the summit of the Silurian or the base of the Devonian limestones. All the evidence that we have on the point has not as yet been perfectly elaborated, but it consists in the general horizontality of the beds wherever seen throughout the whole area, and in the existence of limestones holding fossils on Lake Manitoba, twelve miles distant in a south-westerly direction, and of limestones holding fossils on Lake St. Martin, eleven miles distant in a south-easterly direction. Also reference might be made to the above mentioned bore on Vermilion River, where the gypsum was at the base of a bed of Devonian limestone 130 feet in thickness. Thus these deposits are practically of about the age of the Onondaga Formation of New York and Western Ontario, in which rocks plaster-quarries have been worked for many years. This formation also contains the great salt deposits of Ontario, and it is a significant fact, that a short distance to the west of the area under consideration, around the shores of Lakes Manitoba and Winnipegosis, many brine springs are known to occur. In the State of Michigan, many of the plaster-quarries are also in rocks of about the same age. In Nova Scotia, the gypsum deposits are of lower Carboniferous age, and in Iowa they are stated to belong to a still higher horizon.

The general hilly and irregular character of the surface underlain by the plaster beds, and the fact that isolated hills of gypsum rise above the surface of the otherwise level plain, make it appear probable that the deposits occur as lenticular masses in the beds of limestone which seem to compose the general floor of this whole area, though in most places the limestone is covered either by a mass of glacial till, or by the alluvial deposits laid down on the bottom of the ancient Lake Agassiz. The gypsum also resembles the limestone in being clearly stratified horizontally or at a very low angle. Besides this, some of the limestone of Northern Manitoba contains a large amount of sulphur scattered throughout its mass in the form of minute grains of iron pyrites. The iron pyrites readily oxidises into a sulphate or double sulphate of iron which combining with the carbonate of lime give as products of the double decomposition, sulphate of lime or gypsum, and carbonate or possibly sulphate of iron. In the Cretaceous shales of the Duck and Riding Mountains and of the Plains further west, this process is clearly seen to have gone on. Iron pyrites is constantly present, and the shells of Inocerami, Ammonites, Baculites, etc., furnish an abundant supply of carbonate of lime. This shale is therefore often filled with minute, or sometimes even large crystals of gypsum, and side by side with them are masses of ironstone or impure carbonate of iron, which, after being formed in the above described way, has collected in rounded or lenticular nodules about a shell,

fragment of a crayfish, or other nucleus. In the case of the Paleozoic limestones, however, no trace is found of the carbonate or other salt of iron which would have resulted from the double decomposition, and if it was ever formed in the rock, it has since been dissolved away by water percolating through the strata.

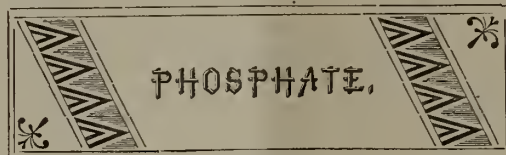
The gypsum may, however, have been formed in a different way. The whole of this country has undoubtedly suffered very considerable erosion since Cretaceous times, the shales and marls of the Duck and Riding Mountains having almost certainly extended much further east than Lake St. Martin. Many of the springs that now flow from these shales are strongly impregnated with sulphuretted hydrogen, which might readily be oxidized into sulphuric acid. This acid acting slowly on the beds of limestone would alter them into sulphate of lime without disturbing the stratification at all.

Of the uses of gypsum it is unnecessary to speak. In the Western States, where the air is dry and atmospheric erosion is very small, it is used as a building stone, being very easily worked, and sufficiently durable and strong for residences and all ordinary buildings.

By roasting, its water of crystallization is driven off and it is reduced to the fine powder commonly known as Plaster of Paris. By grinding the crude gypsum as it comes from the quarries between ordinary burr stones, land-plaster is obtained, a substance of which it is difficult to overestimate the value in a country whose resources are almost entirely agricultural. The soil of Manitoba and the North-West Territories is very fertile now, but a time will come when having raised crop after crop it will need replenishing. The value of this extensive gypsum deposit will then be thoroughly realized. Lying as it does within twelve miles of Lake Manitoba, a navigable stretch of open water extending southward almost to the Manitoba and North-Western Railway, it can readily be brought to all parts of the province. It is also on the line of the projected railway from Winnipeg, between Lakes Winnipeg and Manitoba, to Hudson's Bay, and by this railway would be within one hundred and fifty miles from Winnipeg, and as the intervening country is very level, the cost of carrying it there would not be great.

The Ormerod Safety Cage.—At a recent meeting of the Wigan Mining and Mechanical School, Mr. Edward Ormerod, of Atherton, exhibited and explained to the students his patent safety cage. It is well known that safety hooks and over-winding gear, however perfect, will not deal with the accidents arising from the breakage of a winding rope, in which case the liberated cage rushes headlong to the bottom of the pit, and the occupants, if any, are almost inevitably killed. Even if there are no persons in the cage, very much havoc and destruction of property results. The object of all safety cages is to prevent a cage falling when the rope breaks; the cage grips the conductors and remains firmly and safely suspended. Many safety cages have been introduced, but are chiefly applicable to wood conductors, and do not answer at all for wire conductors. Mr. Ormerod has endeavoured to invent a safety cage which shall be applicable to conductors of any kind, either wood, iron or wire. The experiments made with the model were all completely successful and were witnessed with very much interest by Mr. C. M. Percy M.E., F.G.S., and Mr. R. Betley, F.G.S., and a large number of students. Mr. Ormerod will undertake to fix his safety appliance to any cage or hoist, and if satisfaction is not given will re-

move the appliance free of cost. Not only is the safety cage a means of dealing with accidents by breakage of rope, but it also operates very effectively in supplementing the action of the safety hook in case of an overwind. There have been cases in which the momentum of the cage in falling back after detachment has shattered the safety hook, and the cage has not been held; but with this safety cage there is practically no falling back, because immediately the cage commences to return after detachment the safety appliance comes into operation and holds the cage. The invention is well worth the attention of our colliery managers and colliery proprietors, anxious as they ever are to adopt all appliances which can lessen the number of accidents in connection with collieries.



Shipments.

The following have been the Shipments of Canadian phosphate since opening of navigation to 15th May, from Montreal to Europe:

Date.	Name of Vessel.	Destination.	Shippers.	Quantity.
Apr. 30.	S.S. Lake Nepigon	Liverpool	Lomer, Rohr & Co.	240
May 13.	" Toronto	"	Aglo Can. Phos Co.	350
" 15.	" Lake Winnipeg	"	Lomer, Rohr & Co.	95
" 15.	" Loch Lomond	London	"	567
Total				1252

RECAPITULATION.

Lomer, Rohr & Co. 902
Anglo-Can. Phos. Co. 350

Total 1252 Tons.

At time of writing the following vessels are being loaded: S. S. Oxenholm, by Wilson & Green; S. S. Tremona, by Millar & Co.; S. S. Castellano, Alcides and Montreal, by Messrs. Lomer Rohr & Co.

Mr. T. W. Hotchkiss, American Consul, furnishes us with the following values of the exports of ground phosphate to points in the United States from Ottawa Valley mines:—January, to Chicago, \$1,000; February, to Chicago \$1,000; Buffalo \$519.50; March, to Buffalo \$700; April, to Detroit \$1,349.85.

Kingston District.

The Foxton Phosphate Mining Company was registered in London, Eng., on the 18th ulto., with a capital of £12,000 in £1 shares to acquire and work the phosphate mine formerly owned by Mr. James Foxton, Sydenham. No prospectus was issued to the public, the money being subscribed by a few capitalists. Mr. John Higginson, formerly of the North Star Mines, has been engaged as Superintendent. The work is progressing satisfactorily at the pits, but until everything is well organized no large output is looked for.

Du Lievre.

The shipping of phosphate on the river is now in full swing, and the aggregate quantity daily loaded into cars and coming from the High Rock, Dominion, Emerald and Canadian Co.'s mines average some 250 tons. The ore from the Central lake mine will swell this output; we understand that the first shipments of it are to be made at once.

Prospectors for phosphate properties are very active in this locality, but few of the many operations on foot for the acquisition of phosphate properties appear to materialise.

The Prospectus of the Emerald, Central Lake and Lievre District Phosphate Company will be issued next week.

Mr. O. M. Harris, of the Canadian Phosphate Co., reports that work is proceeding satisfactorily at the mines; about 500 tons have been shipped since opening of navigation.

A small force is doing development work at the Little Rapids mines. A number of very promising shows have been opened on Lot 7, adjacent to mine. Both of these properties have recently been visited by American capitalists, it is said, with a view to purchase

Templeton District.

The Jackson Rae Company has gone to allotment. The capital is \$25,000, in £1 shares, of which 13,000 are offered to the public.

In General.

In his recent Report the Minister of Agriculture cites the following instance of the utility of ground phosphate as a fertilizing agent: "I am creditably informed that an experiment was made during the past year with crude phosphate which had been ground to an almost impalpable powder on a field of potatoes in this district, half of it being treated with this fertilizer, and the other half with ordinary farm yard manure. The result was that the part of the field where the phosphate had been used yielded much larger and cleaner tubers than the other half, the soil in both cases being exactly the same."

A prominent German importer has recently visited the Lievre phosphate region with the object of arranging for larger consignments of Canadian rock to be sent direct to his factory at Hamburg. This gentleman wishes to avoid the brokerage and other charges incidental to the present system of shipment.

Mr. Thomas Macfarlane, F.R.C.S., Dominion Analyst, again calls attention to the large amount of money which farmers pay for the ammonia in fertilizers which might be saved if sufficient care was taken to preserve that contained in barn-yard manure. Nearly the whole of the nitrogen in the fodder fed to farm stock is to be found in the excrements of the animals, and one-half of it is contained in the urine. It is further the fact that 95 per cent. of the potash contained in the food of oxen and sheep may be recovered by carefully saving the liquid manure only. To secure the nitrogen or ammonia and the potash, the means are very simple. The dung from the different animals should be brought together, and kept under cover at a lower level than the stable floor, so that the liquid manure may flow upon, over and down through it. In this way all the different sorts and both parts of the manure are properly blended, the solid part and the bedding kept moist and none of the urine escapes. It is further necessary to strew the stable floor, below and behind the animals, with 2 lbs. per 1,000 lbs. live weight, daily, of ground plaster or sulphate of lime, which has the effect of retaining the ammonia resulting from the decomposition of the liquid, and the fermentation of the solid manure. It has recently been proposed to obtain these results by the use of superphosphate, in place of ground plaster, and experiments by Heiden, Dietzell and others in this direction have been entirely successful. Dietzell mentions that 1½ lbs. of phosphoric acid only are required for the treatment of 1000 lbs. of stable manure. The use of "plain

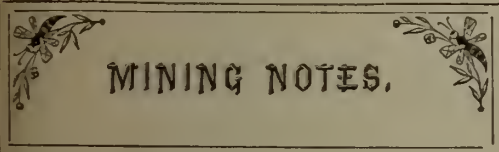
superphosphate" in this way must result in the production of a manure of every excellent quality.

Market.

Messrs. Couper, Millar & Company, London, send us the following report of the Fertilizer market of the United Kingdom :—

About this time last year we had to report that Ammonical materials were "booming" and Phosphates depressed. The position for this year is for the moment reversed, principally through the recent fluctuations in the Nitrate, market. The scarcity of organic Ammonia however, must before long effect an upward influence in prices for this class of material, while phosphates of every description, but in particular, those of high test, are likely to touch much higher prices owing to the unprecedented lowness of stocks and the comparatively small quantity available at the moment.

MINERAL PHOSPHATES.—Canadian 80 per cent. has been sold at 1/0½d. with 1-5d. rise English terms, while 10½d. and 11½d. are asked for 70 and 75 per cent. qualities respectively. South Carolina has been sold lately at 9½d., and there are numerous enquiries from both home and continental buyers, but this figure does not tempt shippers the United States demand being very active. Somme has been largely dealt in this year, and the prices of all qualities are very materially increased as the end of the supply of the higher grades is within measurable distance. Belgian must advance in harmony with other phosphates, but, at the moment it is cheap and therefore well worth attention. Cambridge coprolites offer in such small lots as to be hardly worth mentioning, but business has been down lately at 45 shillings f. o. r. Bedfords are not offering.



We shall be greatly obliged to mine owners and superintendents for such authentic reports of their operations as may concern shareholders and the public.

NOTICE.

At the Annual Meeting of the Gold Miners' Association of Nova Scotia, held at Halifax, on 6th March, a resolution was passed adopting the "Canadian Mining Review" as the official organ of this Association. Our readers may therefore rely upon the accuracy of all information published in these columns bearing on the gold mining industry of the Province.

Nova Scotia.

Lake Catcha District.

The Oxford Gold Mining Co. has just completed a trench about 400 feet long, and drained off the body of water known as Lake Catcha. This throws open and makes prospecting possible on some 16 areas heretofore nothing but swamp. While little is known of the lake bed, good drift has been found indicating valuable lodes in the swamp. Vigorous prospecting has been started and will be continued all season. The mill is crushing on good pay ore.

Malega Lake District.

Considerable activity is displayed in this district, a great deal of prospecting being done with very satisfactory results.

The Parker Douglas Co. are raising good ore from their old workings, and have also opened up a new lode, which is promising. We understand that the owners are very well satisfied

with results and with the general outlook. At present the output of gold is limited, as they have but five stamps in their mill; but this plant will probably soon be enlarged, as they have a body of ore which apparently would warrant the erection of a twenty stamp mill.

The Caledonia Mining Co. are erecting a building for hoisting plant, and the machinery for it has been shipped; an air compressor and drills will be put in also. A contract for sinking a shaft 100 feet has been let.

The Malega Mining Co. are working three lodes, but owing to the recent fire, in which the pumping and hoisting plant of two of them was destroyed, the output of ore has been so curtailed that the twenty stamp mill has been run only on half time. The three lodes from which ore is now being taken are the "Chester," "Rabbit," and "Nine Boulder." The "Chester" is a twelve inch lode yielding one ounce of gold per ton, and which is opened down to a depth of 200 feet; not much ore is being raised here, as it is the purpose of the management to sink and drive. The "Rabbit" lode is thirteen inches thick, yielding by the regular mill run two ounces per ton, and in places is much richer. One ton of ore taken down a short time ago was estimated to contain one hundred and fourteen ounces of gold. The "Nine Boulder" is the largest lode discovered on the property, running from 36 to 43 inches in thickness. It is heavily charged with sulphurets, and yields about fifteen dwt. of gold per ton. This lode being the greatest ore producer of the property, reduces the average yield to one ounce five dwt. per ton from the three lodes combined.

A shaft is now sinking and some drifting being done on the "Nugget" lode, but no ore has been taken down. This lode, though not large, is rich. A piece weighing 200 pounds slid off a short time ago and was broken up. From it 30 pounds of ore was selected which was mortared by hand, yielding 25 ounces of gold.

Tributers are working a five inch lode with satisfactory results, their first crushing having yielded at the rate of one ounce per ton. The company is doing a great deal of prospecting, and new lodes are being opened.

North Brookfield District.

The Philadelphia Mining Company are erecting a steam pumping and hoisting plant. Their last "clean up" gave them 265 ounces. Considerable prospecting is doing in the district.

Westfield District.

The machinery for the plant at the "Jumbo" is on the ground, and work on the mill being crowded. The lode in one place is over 80 feet thick, and it is the intention of the owners to have their plant equipped with all modern appliances for saving both the free and the combined gold.

New discoveries west of this district are attracting considerable attention.

Whiteburn District.

The McGuire mine continues its regular output of gold, and was the largest producer in the province last year, excepting only the Dufferin mine at Salmon River. The Graves' mill has started up again with new facilities for hoisting and pumping.

Gold River District.

The Neptune Gold Mining Co., under the management of C. E. Willis, has been actively engaged during the winter and spring in developing the property purchased by them in December. The company have erected hoisting works, and other necessary buildings, and have a fine ten stamp mill about ready to run.

Two other lodes are being worked in open cuts from the foot of a steep hill, and about one hundred and fifty tons of ore will be taken from each as a test. The company is cross-cutting its property and has opened several lodes on which test shafts will be sunk during the summer.

Mr. McMillan is opening up the property belonging to Messrs. Fulton, Foster & Gammon, and is taking out some very good ore from an eighteen inch lode, on which the shaft is now down forty-five feet. He will shortly start sinking on a five foot lode which has indications of being a good one, and will cross-cut the one hundred foot belt, in which there are some sixty feet of quartz. Should these large lodes prove remunerative, a fifty stamp mill will be required to handle the ore.

Mr. John McGuire has started men prospecting on his claims, and several other owners are about ready to begin, and a large amount of development work will be done during the summer.

The main shaft on the "captain" lode is now down one hundred feet, and drifts have been driven east sixty-eight feet, and west seventy-six feet on the vein. The shaft is now being sunk to the two hundred foot level and will be finished before stoping is begun. The lode, which was eight inches thick where first opened in the shaft, has increased to about two feet at the one hundred foot level, and seems to be increasing in richness as well as in size, as sinking continues. The best ore yet encountered has been taken out between eighty-five and one hundred feet in depth.

Miscellaneous.

At the Pictou County Collieries the prospects of work during the summer are far from encouraging, for at most of the mines, up to the middle of the month, large numbers of men were idle, while those that are employed have much idle time.

At the Acadia colliery the depression is still felt and although no men have been thrown out of employment entirely there has been a good deal of broken time. The sinking of the new lift at this place is being steadily pushed forward.

At the Black Diamond, however, there seems to be a steady demand for the whole of the output, and the only lost time has been caused by some necessary repairs. Work at the Drift to prove the underlying seam has for the present been suspended.

At the Albion mines the Acadia Company is still engaged, at enormous expense, in the re-opening of their mines. The re-opening of the Foord pit is by the utmost care and perseverance being successfully carried on despite the great difficulties that are met with. The sinking of the English slope to the famous Cage pit seam and the reopening of the other slopes still continues. The hydraulic pump failed to give satisfac-

tion, and is now being replaced with a steam one. As at the other collieries, trade is very depressed.

Work is somewhat brisker at the Vale Colliery, and probably this fact has led to another influx of Belgian miners.

In this vicinity a small pit has been opened by a Mr. McNeil, of New Glasgow, but operations at present are suspended.

The Colchester Coal Mining Company purpose commencing operations on their property at Coal Brook early in June.

At the Drummond Collieries the state of trade is such as not to warrant the re-opening of the Scott Pit and No. 4 Slope, consequently men are yet out of employment who have been looking hopefully forward to the resumption of work at these places.

The Cumberland Coal Company, of Springhill, N.S., has bonded a quantity of coal land on Queen Charlotte Island, in the Pacific. On the property there is already a 400 feet tunnel run by a former company. The Nova Scotia company will run the tunnel 400 feet further, and then sink a shaft. It is their intention to institute a thorough search for coal.

Mr. R. G. Leckie late managing director of the Springhill Mines, is negotiating for the purchase of the Joggins Mines in Cumberland County, N.S., which with the Joggins Railway and the neighboring Prospect Mine, are mainly owned in St. John. The price suggested for the principal mine is \$200,000, and for the Prospect Mine \$40,000, while the offer said to have been made for the railway is \$140,000. The railway is twelve miles long.

Mr. W. Hall, manager at Springhill has asked the men to double up in the East and North slopes for a short time, as he is unable to keep the West slope running on account of the quality of the coal.

At Little Glace Bay, banking is about to start for the second time here. It's reported that they will bank 5,000 tons this time, which will make a bank of 15,000 tons with what is already stocked.

The first steamer arrived at the Intercolonial Company's wharf on the 18th instant to load coal for Montreal; it is understood that this is the only boat chartered as yet by this company for the season.

A discovery of coal is reported on land adjoining the Acadia and Black Diamond areas, but up to time of writing no particulars have been obtained. It is understood that these areas have been leased.

Notice is given that a meeting of the Lake View Mining Company (Limited) will be held at Newark, New Jersey, on 8th June, for the purpose of organizing and transacting other business.

Prospecting at Five Islands has been stopped for the present. There has been 500 feet of drifting done, and a shaft sunk 56 feet. Four small seams of coal have been gone through.

The main shaft of the Eastern Development Company, Cape Breton, is down to the third level, 244 feet; one larger stringer of ore had passed out of the slope to the north, and another was just coming in in the bottom. These stringers are part of vein C, which will be cut from this level. Vein B will not be cross-cut to until the next level is reached. Connection between the first and second levels in vein B has been completed by the up slope from the second level; the vein holds in width and quality of ore. The west drift of the second level is now coming in with rich purple and yellow ore. Letters from the mining captain in charge state: "It is the best showing yet made in this rich vein." South cross-cut into the mountain has entered a change of rock, and cut stringers dipping to the north same as the other veins, but nearer perpendicular. It is expected to soon cut vein E at this point. Five ladders and buckets have been provided for all the surface buildings, and the force organized into a fire brigade. The company has received official assurances from Ottawa that the Dominion Government will furnish the rails for the proposed railroad from the mine to Sydney Harbor. Reports from Messrs. Humboldt & Co., of Kalk, Germany, on the treatment of the low-grade ores sent them, show that the 2.25 per cent ore was concentrated up to 9.50 per cent., and the 3.46 per cent. was carried to 12.61 per cent, showing conclusively that the low grades can be handled to advantage.

New Brunswick.

A party of professional and business gentlemen have arranged to visit one of the many coal mines in Queen's County with a view of taking stock therein and pushing the development. It is said that Mr. John Byers, who for many years was the manager of the Albertite mines, and Major Markham are to be of the party.

The Pope Manganese Company have commenced operations at the Markhamville mines, with Mr. W. C. Pope as manager in United States and Major Markham at the mines.

The Philamaroo gold and silver mine is in active operation. Capt. Alley, of Bar Harbor, was in Sussex this week looking after its interests, and also that of his manganese mine on the Glebe in Waterford, where he has a few men prospecting.

Quebec.

An English correspondent informs us that the Asbestos quarry at Coleraine owned by Messrs. Fenwick & Slater, Montreal, has been sold, but at time of writing no particulars have been obtained.

The Anglo-Canadian Asbestos Company have uncovered some large veins in a new pit, and these are said to be yielding stuff of excellent quality.

We have no special information from any of the other mines, operations are, however, going ahead briskly, and things are getting into good shape for the season.

We are informed that nothing has been accomplished by Major Evan's English people with the Ross-Ward mine, and that the matter is now off. Mr. T. H. Carman, Winnipeg, states that he has now obtained an option on the property and that he is negotiating with a strong English syndicate for its sale.

Messrs. M. Beatty & Son, Welland, have shipped a new hoisting engine, boiler and derrick to the Frechette mine at Thetford. It is intended to do a larger business than heretofore at these pits.

Mr. S. P. Franchot, Buckingham, has shipped from Montreal, through Messrs. Lomer, Rohr & Co, 165 tons of feldspar from the Villeneuve mica mine.

Mr. W. H. Dickson, has uncovered a very promising show on his Buckingham plumbago

Ontario.

Port Arthur District.

Notwithstanding the recent constant heavy rains and bad roads, travel into and traffic to and from the silver mining region is steadily increasing. Several heavy New York capitalists are now here in the interests of the railway, and the result of the conference of the combined companies is almost certain to result in a rapid rush of the work for the first fifty miles at least. The shipping of ore from the present rich workings on Silver Mountain East resembles towing in mud scows.

There is nothing unusual to report concerning the various standard mines. Silver Mountain West keeps on developing very richly, and the Badger, Beaver and Elgin are all turning out rich ore. The Beaver is preparing for a steady output to the mill, which will shortly be working.

Docks are being built for the accommodation of the Silver Fox, Wolverine and Queen mines north of Whitefish Lake. It is rumoured that the Palisade and Medicine Bluff veins will shortly be put under development by Eastern capital.

Now that the Minnesota iron lands are so difficult to obtain there is a great rush after iron in various localities in the district. Applications are pouring in for lands for iron extending from Rainy Lake in the west to Nipigon Lake in the east. The taking up of iron lands promises to be one of the large sources of revenue to the province.

The Board of Trade at Port Arthur has had a fine set of cabinets prepared, and is receiving splendid collections from the various mines for exhibition.

The West Beaver mine, as reported, has been successfully floated in England, and the prosecution of work will likely take place at once. This property is most favorably situated, adjacent to the road, railway, and some of the chief producing mines.

The "West End Company" is the name of the new organization which is seeking incorporation, and will operate the famous west end of Silver Mountain on an extensive scale, commensurate with the results anticipated.

Several interests in the Silver Mountain region have recently changed hands at figures realizing handsome profits to the settlers.

Manitoba and North-West Territories.

Notice of application has been made by James Baylis, Montreal, John Lamb, Toronto, Samuel Mathewson Baylis, Montreal, Joseph James Tolfree, Toronto, George Samuel Wait, Montreal, for letters patent to incorporate them under the name of "The Stair Coal Mine and Manufacturing Company."

The purposes for which such incorporation is sought are: 1. The purchase and sale of coal, mineral and other lands near Stair in the District of Assiniboia, in the Northwest Territories and especially in Township thirteen, Range six, west of the fourth principal meridian; and the working of said mines, the quarrying of stone, the manufacturing of bricks and iron, the purchase, erection and operation of flour mills, and the transportation and sale of the products thereof; the purchase, construction, maintenance and operation of all works for, and the employment of all suitable means of, transportation of the products of the same whether by land or by water. 2. Carrying on a general mercantile business in connection therewith. 3. Acting as financial agents, receiving money on deposit and lending money at interest. 4. The construction and operation of telegraph and telephone lines in connection with said mines and works. The chief place of business of the company will be in Montreal, in the Province of Quebec.

It is understood that the Canadian Pacific Railroad Company has agreed with the Government to build a branch line from Brandon southwest 100 miles to the Souris coal district, and also an extension of 25 miles from the present terminus of the Manitoba & Southwestern Railway to a junction with the projected Souris branch above mentioned. The condition which the company undertakes the construction of these lines is the usual grant of 6,400 acres to the mile.—*E. & M. Journal.*

British Columbia.

The Irondale Iron Works, Port Townsend, which have been two years in operation, have increased their capital, and are going to erect rolling mills for the manufacture of steel and wrought iron, in addition to their present output of first-class pig iron, which is much in demand at the Union Iron Works, San Francisco. Their facilities for shipping and transshipping are good. Their magnetic iron ore from their mines located on the Southwest coast of Tuxedo Island, B. C., is of excellent quality. The ore is simply quarried out of a high bluff of iron ore close to the shore; 25 men are employed daily the year round. It is conveyed by steamer to Irondale, Port Townsend, W. T., and mixed with some iron ore found near Irondale, of a limonite character. Lime is shipped from San Juan Island for fluxing, and at little cost of transportation. The company are now employing 400 men or more in mining, making charcoal, and smelting, and it is reported that about 40 tons daily of pig iron is produced. The capital is \$1,000,000, and head office at San Francisco, California.

Twelve months ago a search for coal was made near Comox by the Union Mining Co. Two slopes have been driven 1500 feet and a seam $4\frac{1}{2}$ feet thick of superior coal is now being worked. Eleven miles of railway have been also built to Hart's Point; two locomotives have arrived and 60 coal cars are in course of construction. New hoisting machinery have been put down at the mines and everything is being pushed forward for an early shipment of coal. About 8,000 tons have been banked and await the completion of cars for shipment.

At the meeting of the new Vancouver Coal Mining & Land Company, Mr. Galsworthy, who presided, said 181,470 shares in the new company had been applied for and allotted, and

very few shares were left. The company was now in position to dispose of its property to the executors of Messrs. Rosenfeldt. The output of the mines this year has been better than it has ever been. An interim dividend of $2\frac{1}{2}$ per cent. was declared.

The workmen employed in sinking the No. 6 shaft of the Wellington Collieries, succeeded in reaching the coal on Friday afternoon, and have now got through the seam, which shows excellent coal eight feet thick. The No. 6 shaft is situated down the Mill stream valley, in the direction of the East Wellington Colliery property, and conclusively proves the large area of the coal property of Messrs. Duusmuir & Sons.

The Pacific Bullion Mining Co. has been registered at Victoria under the Companies Act. The object for which this company is formed is for the mining, milling, smelting and working of ores and minerals contained in the mines known as the Spokane and Trinket, situated in the West Kootenai Mining district, formerly known as the Warm Spring Mining district near Kootenai Lake, British Columbia, and such other mines as the company may hereafter acquire. The amount of capital stock is one million dollars, divided into one million shares of the par value of one dollar each, and said stock to be unassessable. The place of business of the company is at Nelson Warm Springs, Lower Kootenai Mining district, British Columbia.

The Crow's Nest Coal and Mineral Company Limited is applying for a certificate of incorporation. The company is formed for the purpose of acquiring and selling coal and mineral lands in the Province of British Columbia, and working the same in a miner-like manner, and extracting the coal and mineral therefrom, and selling the said coal and mineral extracted therefrom, and for erecting and using all the buildings, machinery and plant, railways, tramways and roadways necessary for working and winning coal and mineral from the said lands in an efficient and workmanlike manner, and transporting the same to place of shipment, and for the purpose of erecting all the necessary buildings, machinery and appliances therefor, and for the purpose of building or purchasing steamships or other vessels to carry and convey the said coals, coal oil and materials, and articles of merchandise from the place of shipment to whatever place may be desired by the company, and generally to use the said vessels and steamships in connection with the business of the said company. The amount of the capital stock of the company is two million dollars, divided into twenty thousand shares of one hundred dollars each. Five trustees shall manage the concerns of the company for the first three months, viz.: Lieutenant-Colonel James Baker, Joseph Despard Pemberton, William Ferne, Peter Creak Fernie and Edward Bray. The principal place of business of the said company shall be at the City of Victoria, in the Province of British Columbia.

Improved Ore Stamps.—An improvement has been invented by Messrs. C. E. Appleby and G. E. Abrahams, London, Eng., the object of which is to increase the power and efficiency of the ordinary ore stamps, which are raised by a series of cams upon a revolving shaft, and are then allowed to fall upon the ore or other material to be pulverized. According to the arrangement which has hitherto

been general, the stamps depend for gravity alone for their pulverizing force, but the inventors have determined to employ additional mechanism for assisting the stamps in their downward course. For this purpose a piston is fitted by a universal joint to the upper end of the stamp, and it moves in an upright cylinder which is closed at the upper end. When the stamp is displaced in an upward direction by the cam the piston compresses the air within the cylinder, and after the action of the cam has terminated the compressed air assists the attraction of gravity in forcing the stamp upon the material. The same result may be gained if a spiral spring is arranged within the cylinder, and an additional effect is obtained if both the spring and the air are employed. The upper end of the cylinder may be raised or lowered so that the degree of compression may be varied according to circumstances. Two claims are made for the method of aiding gravity by means of the compressed air and spring.

Canadian Mines on the English Market.

	Price Per Share.
General Mining, Limited £219,752 fully-paid shares of £8	4 $\frac{1}{4}$ 4 $\frac{1}{4}$
Low Point, Barrasois and Langan, \$309,100 fully-paid shares of \$100	—
Ditto, \$200,000 vendors fully-paid shares of \$100	—
Northwestern Coal and Navigation, Limited, £160,500 6 per cent. debentures; coupons June 30 and Dec. 31; principal 1904	—
Ditto £149,500 fully-paid ordinary shares of £10	—
Ditto £900 fully-paid deferred shares of £100	—
Sydney and Louisburg Coal and Railway, Limited, £50,000 cumulative 10 per cent. first preference shares of £10	7 9
Ditto, £14,560 fully-paid non-cumulative 6 per cent. second pref. of £10	3 5
Ditto, £250,000 fully-paid ordinary shares of £10	1 2
Vancouver Coal Mining and Land, Limited, £66,850 fully-paid shares of £10	—
Ditto, £118,150 shares of £10, £9 paid	6 $\frac{1}{2}$ 7 $\frac{1}{2}$
Excelsior Copper, Limited, fully-paid shares of £1	—
Ditto, shares of £1, 17s. 6d. paid	—
Shuniah Weachu, Limited, £99,888 fully-paid shares of £1	—
Silver Wolverine, Ltd., £68,465 fully-paid shares of £1	—
Anglo-Canadian Asbestos, Limited, £39,132 fully-paid shares of £2	—
Anglo-Canadian Phosphate, Limited, £46,340 fully-paid pref. shares of £10	—
Ditto, £15,050 fully-paid deferred shares of £10	—
British Columbia Smelting, Ltd., £25,000 preference shares of £1, 10s. pd.	—
Ditto £40,000 fully paid ordinary shares of £1	—
Canadian Asbestos and Antimony Company, Limited, £160,000 fully called shares of £5	—
Canadian Phosphate, Ltd., £100,000 fully paid shares of £1	—
Bell's Asbestos, Limited, £100,000 fully paid shares of £5	18 $\frac{1}{2}$ 18 $\frac{1}{2}$
White's Asbestos, Limited, £20,000 fully paid shares of £1	—
Ditto shares £1 paid	—

General Mining.—Accounts to December 31 submitted in April, but an interim meeting is held in November. Dividend for 1884, 5 per cent; for 1885 and 1886, $3\frac{1}{2}$ each year; and for 1887, £4 13s. 9d. per cent. Reserve fund, £29,850.

Low Point.—The vendors' shares, up to the end of 1888, do not rank for dividend until 7 per cent. per annum dividends have been paid on ordinary. Accounts to Dec. 31. For 1887, 5 per cent. was paid on the ordinary shares other than those held by the General Mining Assoc., that Company foregoing their dividend rights.

North-Western Coal.—The deferred shares receive on dividend until 15 per cent. per annum (cumulative) has been paid on the ordinary. Accounts to June 30. Dividend for 1887-8, 5 per cent.

Sydney and Louisburg Coal.—Accounts to Dec. 31 submitted about May. Out of the profits of 1884 one half-year's dividend on the first preference shares was paid. No dividend since. Debit to Dec. 31, 1887, £1,574.

Vancouver Coal.—Accounts to June 30 and December 31 submitted in November and May. In the half-year to June, 1888, there was a net profit of nearly £11,000. Debentures, £57,200. Reconstruction has been decided on.

Excelsior Copper.—Registered September 26, 1888. Authorized capital, £450,000; purchase consideration, £400,000, in cash or shares. Fully-paid shares issued to the vendor; partly paid to the public.

Shuniah Weachu.—Accounts to Nov. 20 submitted in February. No dividend yet.

Silver Wolverine.—Registered October 19, 1888, with a capital of £100,000, of which £80,000 was the first issue. Most of the shares were issued to the vendor.

Anglo-Canadian Asbestos.—The Company was registered in November, 1885. Accounts to October 31 submitted in March. No dividend yet. Debentures, £3,450. Reports are not obtainable, but this information is official.

Anglo-Canadian Phosphate.—The preference shares rank first for 7 per cent., and after a like rate has been paid on the deferred shares, both classes rank equally.

British Columbia Smelting.—The company was registered May 9, 1888. The ordinary shares were issued to the vendor, and they do not rank for dividend until the preference shares have received dividends amounting to 100 per cent.

Canadian Phosphate.—Accounts to November 30 submitted in February. Eleven months to Nov. 30, 1888, resulted in a profit of £2,576, which was carried forward.

White's Asbestos.—Registered April 9th, 1889. The authorised capital is £100,000; first issue, £60,000, of which £20,000, fully paid, was issued to the vendor.

Coal Mining in Nova Scotia.*

By E. GILPIN, JR., A.M., F.G.S., F.R.S.C., etc., Deputy Commissioner and Inspector of Mines for Nova Scotia.

The earliest discoverers do not mention coal in their accounts of Cape Breton, although its outcrops in the sea cliffs are visible for miles. The first printed account is found in Denny's work, published in 1672. In 1711 considerable amounts of coal were taken away by the French and English, being broken out by crowbars and loaded into boats. The building of the great fortress of Louisberg in 1720 led to the first regular coal mining in the Island of Cape Breton. The great numbers of artificers, soldiers, etc., engaged in its construction were supplied with fuel from the ten feet seam on the north side of Cow Bay, now known as the Block House seam. These old workings were carried on above water level, and can still be entered.

During the English occupation of Cape Breton from 1745 to 1749, the beds of coal at Burnt Head and Little Bras D'Or were drawn upon for fuel, and block houses were built to protect the workmen against the Indians and pirates. In 1752 the pit at Burnt Head took fire, and the fort and other buildings were burned. The traces of the fire are still visible for nearly a mile along the outcrop of the seam. From this date until 1784, when Cape Breton was erected into a province, little was done in the way of coal mining. No satisfactory leases were issued, and the records show little beyond the supplies of fuel dug by the soldiers for the garrison at Halifax, and the steps taken to prevent theft of the coal by Americans, etc.

In 1820, when the island became part of the Province of Nova Scotia, more decided steps were taken, and considerable amounts of coal were mined from the Sydney main seam. Finally, in 1827, all the mines of the province passed into the hands of the General Mining Association of London. It may be remarked here that in the Pictou and Cumberland districts the coal seams attracted less attention, as they were not so accessible as in Cape Breton; but previous to 1827 numerous attempts were made to open mines in Pictou County. The causes of the ill success of all these ventures hitherto made were the excessive royalties charged, the shortness of the leases, two to five years, and the want of a regular market.

From 1785 to 1827 the annual coal sales in Cape Breton varied between 2,000 and 11,000 tons. The selling prices per ton being about \$2.50. The royalties charged were from 60 to 90 cents per ton.

The transfer of the Crown mineral franchises of the province was a curious one, and marks almost the last of the excessive prerogatives exercised by the English crown in colonial matters. The Duke of York having become greatly embarrassed financially, his brother King George the Fourth, by an act of the Royal prerogative, granted him for 60 years all the mines and minerals of the province, subject to certain rents and royalties, for the purposes of the provincial civil list. This princely gift recalling the generosity of eastern potentates, was transferred by the Duke of York to the great firm of London jewellers, Messrs. Rundell & Bridge, who had organized the General Mining Association of London, for the purpose of acquiring and working mines in various parts of the world.

This company expected at first that the copper ores of Nova Scotia would prove a source of revenue to them, but after a careful mineral survey they decided to turn their attention to

the coal deposits. They vigorously opened mines at Sydney, Bridgeport and Lingan in Cape Breton, in Pictou County at a point now known as Stellarton and at the Joggins in Cumberland County, and worked them with varying success up to the year 1858, which saw the opening of a new page in this history.

The monopoly was at first viewed with great approval in the province, and the immense expenditures necessarily involved in starting these mines, and their equipment of foundries, machine shops, tramways, etc., were favourably received by a scattered population, entirely engaged in farming, fishing, and lumbering. In a few years however, as population and enterprise increased, the restrictions of so great a monopoly began to cause irritation, which found expression in many an angry speech in the Provincial Legislature. Finally in 1858 the General Mining Association agreed with the province that they would retain for a term of 18 years certain large tracts of coal lands, with powers of extension under lease, and surrender for ever all other coal seams and other minerals. The consideration for this was the reduction of the royalty on large coal to 4^s d, and the abolition of the fixed rent of £3,000 per annum. The General Mining Association under this agreement retained possession of 46 square miles of coal lands. These areas were selected by Mr. R. Brown, then their general manager, with excellent judgment. His work on the coal fields of Cape Breton gives the coal mining history in full detail.

By the judicious and well timed compromises made by the four parties interested—the crown, the representatives of the Duke of York, the Province of Nova Scotia, and the Association, a happy settlement of this great monopoly was arrived at. The incubus of a single corporation, owning by an unassailable title the varied minerals of a province, in great measure settled by those who left the rebel colonies to live under the English flag, was happily removed in time to prevent the development of feelings inimical to the powers that thoughtlessly perverted the guerdon of nature to those who had, by the greatest possible test, demonstrated their loyalty.

The energy and wealth of this company was of great benefit to the province, and its conduct and that of its chief officers has ever been honourable, and calculated to set an example of honesty and reliability. The Association has now disposed of all the coal lands owned by it in Nova Scotia proper, and retains its selections in Cape Breton, operating chiefly in the historical Sydney main seam, which has been drawn upon by the miner for over one hundred years.

The natural result of the unlocking of so vast an amount of possibilities of mineral wealth beyond the dreams of avarice followed this settlement. The development of the gold, gypsum and other minerals immediately followed the period during which the simple farmer doubted if clay were a mineral or not. The government upon the completion of the agreement threw open the coal districts, and leases were readily obtained. A large number of collieries were opened and much speculation indulged in. The 24 per cent. *ad valorem* duty on coal going into the United States having been removed in 1853, it was anticipated that an unbounded market was assured. The total sales in 1858 were 226,725 tons, of which 186,743 were sent to the States. From this date up to 1867, when a duty of \$1.25 was imposed, the exports to the United States had increased to 404,252 tons out of a total sale of 471,185 tons.

In 1872 the duty was lowered to 75cts., when the United States took 154,092 tons out of 785,914 tons sold. Last year the States took

73,892 tons (of which about 50,000 tons were smalls) out of a total of 1,519,684 tons sold. These figures show the steady growth of the home markets, and the fact that there is at present little room for Nova Scotia coal in the New England markets. The mutual removal of the duties on soft coal would, in the opinion of many of the provincial coal mine managers, result in the almost total loss of the Upper St. Lawrence trade, without any prospect of replacing it by a trade with the Eastern seaboard of the United States, which would have to start with a basis of at least 750,000 tons.†

The following tables show the coal sales to the United States for number of years, and the annual sales to all quarters by decades:—

*The ton of coal in this paper is 2,240 lbs.

COAL.

NOVA SCOTIA EXPORTED TO THE UNITED STATES.

Years.	Tons.	Duty.	Years.	Tons.	Duty.
1850	118,173	24 ^s ad.	1869	257,485	\$1.25
1851	116,274	"	1870	168,180	"
1852	87,542	"	1871	165,431	"
1853	120,764	"	1872	154,092	75c
1854	139,125	Free	1873	264,760	"
1855	103,222	"	1874	138,335	"
1856	126,152	"	1875	89,746	"
1857	123,335	"	1876	71,634	"
1858	186,743	"	1877	118,216	"
1859	122,720	"	1878	88,495	"
1860	149,289	"	1879	51,641	"
1861	204,457	"	1880	123,423	"
1862	192,612	"	1881	113,728	"
1863	282,775	"	1882	99,302	"
1864	347,594	"	1883	102,755	"
1865	465,194	"	1884	64,515	"
1866	404,252	"	1885	34,483	"
1867	338,492	\$1.25	1886	66,003	"
1868	228,132	"	1887	73,892	"

Nova Scotia coal sales from 1785 to 1887.

Year.	Sales.	Year.	Sales.
1785 to 1790.....	14,349	1841 to 1850....	1,533,798
1791 to 1800.....	51,048	1851 to 1860....	2,399,829
1801 to 1810.....	70,452	1861 to 1870....	4,927,339
1811 to 1820.....	91,527	1871 to 1880....	7,377,428
1821 to 1830.....	140,820	1881 to 1887....	8,992,226
1831 to 1840.....	839,981		

The following figures will show the markets in which Nova Scotia coal is being sold at present:—

COAL.—SALES.—1887.

Markets.	Year 1887.
Nova Scotia:	
Land Sales.....	266,005
Sea borne.....	203,459
N. S.—Total.....	469,464
N. Brunswick.....	186,511
Newfoundland.....	82,053
P. E. Island.....	50,615
Quebec.....	650,857
West Indies.....	6,140
United States.....	73,892
Other countries.....	151

Total..... 1,519,684

The limits of this paper would be too extended were the geological and chemical particulars of the Nova Scotia coal beds to be given here, and the author trusts that at some future time the society may see fit to allow a description of them to find a place in the transactions.

The coal of Nova Scotia is bituminous and frequently coking, the differences in quality between the various districts being referable perhaps to local conditions of pressure, etc. Stratigraphically the Cape Breton seams hitherto worked are flat lying, those of Pictou and Cumberland are pitching, the average of the former being, say, 1 in 10, of the latter 1 in 3. The thickness of the seams worked in Cape Breton varies between 4 ft. 9 in. and 9 feet, of the Pictou seams 4 to 15 feet, and of the Cumberland seams 3 ft. 6 in. to 11 feet. The conditions of floor and roof vary in each mine but do not present any striking peculiarities. In the thicker seams when the roof is bad, it is sometimes

*Paper read before the Canadian Society of Civil Engineers.

practicable to leave on a few inches of coal to assist in supporting it. In some cases this coal is recovered when the pillars are drawn.

The earliest operations in the pitching seams of the Pictou district were conducted by sinking pits to gain successive lifts. The Pictou main seam, having a thickness of 38 feet, has so far been mined on two systems, of which the following account, taken from a paper read by the author a number of years ago before the North of England Mining Institute will serve as a description. The first system has now been abandoned, but it is interesting, as by it the coal was taken to the full height.

Levels were turned right and left from the pit, and when the shaft pillar was won, incline or gate roads were driven uphill, one half on the angle of the seam every 50 yards. Six "bords" or working places, 18 feet wide, were turned away as the gate road went up, parallel to the levels, and at distances far enough apart to secure pillars 8 to 10 yards thick. Eighteen inches of coal were left on as a roof. These "bords" were driven 12 to 15 feet high and continued until intersected by the next "gate" road. Rails were laid up the gate roads and into the bords, and over them the tubs, holding 12 bushels, were drawn by horses, into the working faces, filled, and taken down to the level. The force of the loaded tub descending the inclined gate road was lessened by fastening to the rear of the tub a loose chain passing round a stout post, fixed at the head of the gate road, and dragging on the ground.

When it was determined to work the lower division of the seam, the same gate roads were driven level until the bottom of the coal bed was reached, and then continued as before. The second lift of 15 to 20 feet in height was taken

out in bunches of regular open cast work in the former bords already worked on the top of the seam. Beams of 6 inch timber placed horizontally at the level of the pavement of the former bords secured the sides of the pillars, and if the roof proved bad, props were set on them. This plan of working was attended with much danger to the miner. His eye could not reach the roof of these murky chambers, and his candle's gleam was reflected only by the white fungus which covered the timber. The shape of the pillars at right angles to the dip, narrow, and having long jibs, was not calculated for strength. The dip of the seam rendered the course of the bords imperative, and the ribs were weakened by the cleat of the coal running obliquely across them. These pillars were never robbed, and have now nearly all crushed. As considerable amounts of gas were given off, ventilation was attended with difficulty, and serious fires happened, some of which were put out only by filling the workings with water.

The plan now most in favour is to drive a "balance" 10 feet wide and 10 feet high from the level straight to the rise of the seam for a distance of about 450 feet. One or more parallel airways are driven at the same time, and of smaller dimensions, in order that the necessary air may be carried uphill and down again as the work progresses. Two tracks of about 2 feet gauge are laid in the balance to within 20 feet of its face. Upon one of these tracks is placed an empty tub to be filled with ballast, on the other a truck having its floor made level through one pair of wheels being greater in diameter than the other. A section of rail corresponding in gauge to that used in the pit is laid on the platform.

(To be continued.)

POSITION WANTED.

A practical Certificated Colliery Manager is open for engagement. Twenty years experience in every system of Coal Mining in some of the largest collieries in the North of England and in Nova Scotia. Large experience in sinking and timbering shafts.

Address:

COLLIERY MANAGER,
Canadian Mining Review,
Ottawa, Ont.

LEDOUX & COMPANY,

10 CEDAR ST, NEW YORK,

Engineers, Metallurgists & Assayers.

Public Ore Sampling & Storage Works

All the principal buyers of furnace materials in the world purchase and pay cash against our certificates of assay, through New York banks.

By special permission of the Secretary of the Treasury of the United States, cars of ore or copper matte passing through in bond can be opened and sampled at our works.

Consignments received and sold to highest bidder. Send for circular giving full particulars.

Mines examined and sampled. Assays and Analyses of all kinds.



DODGE PATENT

Wood Separable Split Pulleys

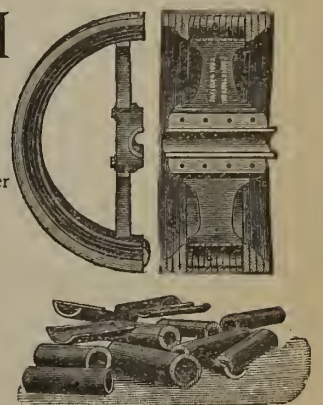
Best Belt Surface, Lightest, Strongest, Best Balanced and Most Convenient Pulley in the World.

WITH OUR PATENT BUSHING SYSTEM

In Comparing Prices of Pulleys please note carefully the following:

1. Our list is lower than most others.
2. Every Pulley is a Split Pulley.
3. Every Pulley is guaranteed to transmit from 25 to 60 per cent. more power than an iron one with same tension of belt.
4. Our Pulleys are 70 per cent. lighter than iron pulleys.
5. The fastening does not mar the shaft.
6. They are perfect in Balance.
7. They can be used on many different sizes of shafting.
8. They are the most thoroughly made wooden pulleys in the world.
9. And the handsomest pulley on the shaft.
10. No chances to take. Every pulley as represented or no sale.

Order a Sample Pulley, after which you will have no other.



EVERY PULLEY IS A SPLIT PULLEY

Made in any size from 9 inches to 16 ft. diameter with original bores of 3 and 3½ inches, bushings to be used for intermediate sizes; larger ones bored to order.

WE ALSO MANUFACTURE

WOODEN GROOVED PULLEYS FOR THE TRANSMISSION OF POWER BY MANILLA ROPE,

Under the Dodge Patent System from 5 to 500 h. p. State power to be transmitted, speed of shafts, relative position of shafts, distance between shafts, and we can furnish a clear estimate.

EVERY PULLEY WILL FIT.

22 or more sizes of Shafting. 200 of our Pulleys and an assortment of bushings represent as many as 4,000 iron pulleys, a great advantage to dealers carrying stock.

Apply for particulars to **The Dodge Wood Split Pulley Co., 111 Adelaide Street West, Toronto.**



CRUDE AND MANUFACTURED FOR ALL PURPOSES.
Cloths, Packings, Furnace Cements, Paper, Stove Linings, &c.

SPECIALTIES: FIREFELT, a flexible Asbestos Sheet, made in tubular sections and rolls, best and most durable non-conductor made.
SUPERATOR, a strong fire & waterproof fabric for sheathing & roofing buildings, fire proofing boiler rooms, &c.

THE CHALMERS-SPENCE CO.,

419 TO 425 EIGHTH ST., NEW YORK.

ASBESTOS.

The Ventilation of Mines.—Recent explosions in mines have again brought into discussion the very important question of the quantity of air required to be sent into the workings of a mine, and it may be remarked that what would be sufficient in one mine might not be sufficient in another, so much depending upon the nature of the workings, on the strata, and other matters. In one case, indeed, where there was a sudden outburst of gas, a powerful fan was working, sending at the rate of 220,000 cubic feet of fresh air per minute through the mine, yet that was insufficient for preventing the air and gas combining to an inflammable point even in the fan drift. In another case 14,000 cubic feet per minute were sent into one portion of a mine, but was ineffectual in preventing an explosion. Opinions vary a good deal, however, with respect to the quantity of air that should be sent into mines under certain conditions. Mr. J. T. Taylor, in his evidence before a select committee, said the quantity depended upon the condition and requirements of a mine. In a mine which yielded no firedamp, he said, "I should say that a current of 20,000 to 30,000 cubic feet per minute might be a fair quantity being properly conveyed up to the face of the workings and made to sweep those districts where the people were employed; but in a fiery mine I should require very much more than the quantity named." For vital chemical purposes alone, Mr. Richardson has estimated that there should be allowed, per hour, for breathing 84 cubic feet per man; for displacing carbonic acid, 62.8; for diluting nitrogen, 258.4; for displacing perspiration, 27.0; for the combustion of one light, 59.3; and for one-fifth of that needed for a horse, 517.0, making a total of 1,008.5 cubic feet. But even this does not provide for quite diluting the gases to a point whereby they would be no longer injurious, nor for removing the air after it has been treated, especially where a number of men have been continuously at the face of a rock. Indeed, experience has shown that a highly ventilated mine may be suddenly inundated with an explosive mixture paralysing for a time the most active agency of ventilation, so that the safety lamp alone has had to be relied upon for the escape of the workmen, thus showing that in a mine where gas is known to be given off in considerable quantities, any calculation as regards the quantity of air supplied to the workings cannot be looked upon as reliable. There should be no measuring of that element which is really vital to those working underground, but that the supply of air should be as large as possible and at the same time continuous, the stream being forced into all parts of the mine. Still, it is well that the question of air in mines should at all times occupy the attention of managers, and that they should be acquainted with the quantities of air individually required even where there is comparative, if not entire, freedom from explosive gases, and it is with this object in view that attention is again drawn to the subject of the ventilation of mines.—*Colliery Guardian.*

A Large Wire Rope.—One of the largest, if not the largest wire ropes manufactured in Great Britain, was recently despatched from the works of Dixon & Corbett and R. S. Newall & Co., Gateshead. Its length is 4,560 yds. and its circumference 5 inches, and it weighs over 23 tons, and it occupied three large railway trucks. It will be used by the North British Railway Company for drawing trains from Cowlands Station to Glasgow.

JOHN D. FOSSARD, B.S., M.E.

MINING ENGINEER & GEOLOGIST,

30 St. Francois Xavier St., - - Montreal.

Specialty—Phosphate Lands.



TENDERS.

SEALED TENDERS, marked "For Mounted Police Provisions and Light Supplies," and addressed to the Honourable the President of the Privy Council, Ottawa, will be received up to noon on Tuesday, 18th June, 1889.

Printed forms of tender, containing full information as to the articles and approximate quantities required, may be had on application at any of the Mounted Police Posts in the North-West, or at the office of the undersigned.

No tender will be received unless made on such printed forms.

The lowest or any tender not necessarily accepted.

Each tender must be accompanied by an accepted Canadian bank cheque for an amount equal to ten per cent. of the total value of the articles tendered for, which will be forfeited if the party declines to enter into a contract when called upon to do so, or if he fails to complete the service contracted for. If the tender be not accepted the cheque will be returned.

No payment will be made to newspapers inserting this advertisement without authority having been first obtained.

FRED. WHITE,
Comptroller, N. W. M. Police.

Ottawa, May 10th, 1889.



SEALED TENDERS marked "For Mounted Police Clothing Supplies," and addressed to the Honourable the President of the Privy Council, Ottawa, will be received up to noon on Friday, 31st May, 1889.

Printed forms of tender containing full information as to the articles and quantities required, may be had on application to the undersigned.

No tender will be received unless made on such printed forms. Patterns of articles may be seen at the office of the undersigned.

Each tender must be accompanied by an accepted Canadian bank cheque for an amount equal to ten per cent. of the total value of the articles tendered for, which will be forfeited if the party declines to enter into a contract when called upon to do so, or if he fails to complete the work contracted for. If the tender be not accepted the cheque will be returned.

No payment will be made to newspapers inserting this advertisement without authority having been first obtained.

FRED. WHITE,
Comptroller, N. W. M. Police.

Ottawa, May 6th, 1889.

Diamonds, Jewelry, Watches & Silverware

AT ROSENTHAL'S

Goldsmith's Hall, 87 Sparks St.

OTTAWA.

INSOLVENT NOTICE.

In the matter of **BRADFORD L. NOWELL & Co.**, of the City of Montreal, Insolvents.

Lands and Phosphate of Lime Mining Rights in the Province of Ontario and Quebec for Sale by Authority of Justice.

I am instructed by the undersigned Curator to sell by Public Auction, within my Sale Rooms, No. 1747 Notre Dame St., on

Tuesday, the 28th day of May next,

At 11 o'clock in the forenoon,

All and singular those certain tracts or parcels of land and premises situate, lying and being in the Township of Loughborough, in the County of Frontenac, in the Province of Ontario, and more particularly described as follows, to wit:

LOT No. 1.

Ninety acres, more or less, of the North part of lot Number Six, in the Tenth Concession of the said Township, described as follows: commencing at the North-East angle of said lot, thence West the width of said lot or thirty chains, thence South along the side line thirty chains, thence East thirty chains, thence North thirty chains to the place of beginning. Together also, with all mines and quarries of metals and minerals, in or under the land upon that portion of said lot being West of the West Bay or Gold Lake, whether already discovered or not, with liberty of ingress, egress and regress for the purpose of removing the same only.

LOT No. 2.

All the Phosphate of Lime in and upon lot Number Ten, in the Eleventh Concession of the said Township of Loughborough, with full, free, irrevocable sale and exclusive license to mine and work all and every one of the mines, veins and seams of Phosphate of Lime opened as well as unopened, in and upon the said lot without any interruption, claim or disturbance from or by the Proprietor of said lot or any other person whomsoever, and to carry away and dispose of all such Phosphate of lime as may be found therein, to and for their own use and benefit and for the purpose aforesaid to sink and make shafts, pits, levels, trenches, ways, gates and watercourses, and to erect and use any machinery, workmen's or other houses, and to use all lawful ways and means whatsoever for finding and removing the said Phosphate, and also to take and use sufficient ground, heaproom or pitroom, for placing the said Phosphate and for leaving the waste, refuse or rubbish to be from time to time produced from the said mines, and also with the full and free liberty to erect, construct or use any part of the said premises, or any roads or ways therein for any purposes connected with the said mines, and the removal, sale and delivery of the produce thereof, provided in so doing they do not injure the crops or other property on said lot.

LOT No. 3.

All the Phosphate of Lime and the full rights to mine the same in certain parcels or tracts of land situate, lying and being in the Township of Buckingham, in the County of Ottawa, in the Province of Quebec, comprising 200 acres more or less, and being west half of lot 21, and east half of lot 22, of the Eleventh Concession of the said Township of Buckingham. These rights are wholly undeveloped, no mines having as yet been opened on the property.

The lots will be sold separately, subject to existing mortgage and the reservations, limitations, provisions and conditions expressed in the original grant from the Crown.

Terms cash, or half cash, and the balance on approved security at three and six months.

All information can be had on application to the undersigned,

SAMUEL C. FATT,
Curator.

WILLIAM H. ARNTON,
Auctioneer.

FRASER BUILDINGS,
43 St. Sacrament St.,
Montreal, 25th March, 1889.

If you want

BAGS

FOR PACKING

ASBESTOS, PHOSPHATES, ORES, &c.,
Send to us for Samples and Prices.

Every quality and size in stock.

Specially strong sewing for heavy materials.

Lowest prices compatible with good work.

We now supply most of the Mining Companies, and those who have not bought from us would find it to their advantage to do so.

THE CANADA JUTE COMPANY (LTD.)

17, 19 & 21 ST. MARTIN STREET,

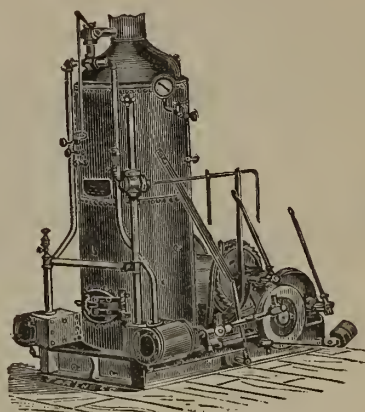
Established 1882.

MONTREAL.

M. BEATTY & SONS,
WELLAND, ONT.

HOISTING
ENGINES

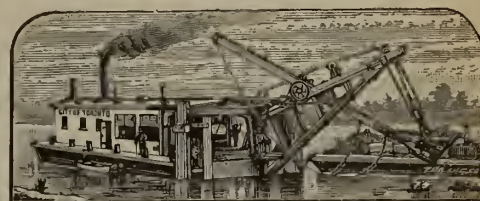
ENGINES
FOR
Mines
AND
Inclines



Horse-Power Hoisters,

Stone Derrick Irons,

Centrifugal Pumps.



DREDGES,

DERRICKS,

STEAM SHOVELS,

And other Contractors' Plant.

AMALGAMATING MACHINERY.

Stamp Mills for Wet or Dry Crushing. Huntington Centrifugal Quartz Mill. Drying Cylinders. Amalgamating Pans, Settlers, Agitators and Concentrators. Retorts, Bullion and Ingot Moulds, Conveyors, Elevators, Bruckners and Howell's Improved White's Roasting Furnaces, Etc.

CONCENTRATING MACHINERY.

Blake, Dodge and Comet Crushers, Cornish Crushing and Finishing Rolls, Hartz Plunger and Collom Jigs. Frue Vanner & Embrey Concentrators, Evans', Calumet, Collom's and Rittenger's Slime Tables. Trommels, Wire Cloth and Punched Plates. Ore Sample Grinders and Heberle Mills.

FRASER & CHALMERS, MINING * MACHINERY.

Improved Corliss and Slide-Valve Steam Engines,
Boilers--Horizontal, Vertical and Sectional,
IMPROVED STEAM STAMPS.

Holting Engines, Safety Cages,
Safety Hooks,
Ore Cars, Water and Ore Buckets,
Air Compressors, Rock Drills, Etc.
General Mill and Mining
Supplies, Etc.



Pumping Engines and Cornish
Pumping Machinery,
Improved Water Jacket
Blast Furnaces for Galena and
Copper Ores.
Slag Cars and Pots,
Roots & Baker Pressure Blowers,
Suspended Tramways.

Sectional Machinery for Mule-Back Transportation.

General Offices and Works: FULTON & UNION STS., CHICAGO, ILL.

BRANCH OFFICES: NEW YORK, Room 43, No. 2 Wall St. DENVER, COLO., 1316 Eighteenth St. SALT LAKE CITY, UTAH, 7 West Second South St. LONDON ENGLAND, 23 Bucklersbury, E. C. CHIHUAHUA CITY, MEXICO, No. 11 Calle de Juarez. LIMA, PERU, South America. JOHANNESBURG, TRANSVAAL, South Africa.



Mining Regulations

TO GOVERN THE DISPOSAL OF

Mineral Lands other than Coal Lands, 1886.

THESE REGULATIONS shall be applicable to all Dominion Lands containing gold, silver, cinnabar, lead, tin, copper, petroleum, iron or other mineral deposits of economic value, with the exception of coal.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein, either by surface or subterranean prospecting for mineral deposits, with a view to obtaining under the Regulations a mining location for the same, but no mining location or mining claim shall be granted until the discovery of the vein, lode or deposit of mineral or metal within the limits of the location or claim.

QUARTZ MINING

A location for mining, except for iron on veins, lodes or ledges of quartz or other rock in place, shall not exceed forty acres in area. Its length shall not be more than three times its breadth, and its surface boundary shall be four straight lines, the opposite sides of which shall be parallel, except where prior locations would prevent, in which case it may be of such a shape as may be approved of by the Superintendent of Mining.

Any person having discovered a mineral deposit may obtain a mining location therefor, in the manner set forth in the Regulations which provides for the character of the survey and the marks necessary to designate the location on the ground.

When the location has been marked conformably to the requirements of the Regulations, the claimant shall, within sixty days thereafter, file with the local agent in the Dominion Land Office for the district in which the location is situated, a declaration or oath setting forth the circumstances of his discovery, and describing, as nearly as may be, the locality and dimensions of the claim marked out by him as aforesaid; and shall, along with such declaration, pay to the said agent an entry fee of FIVE DOLLARS. The agent's receipt for such fee will be the claimant's authority to enter into possession of the location applied for.

At any time before the expiration of FIVE years from the date of his obtaining the agent's receipt it shall be open to the claimant to purchase the location on filing with the local agent proof that he has expended not less than FIVE HUNDRED DOLLARS in actual mining operations on the same; but the claimant is required, before the expiration of each of the five years, to prove that he has performed not less than ONE HUNDRED DOLLARS' worth of labor during the year in the actual development of his claim, and at the same time obtain a renewal of his location receipt, for which he is required to pay a fee of FIVE DOLLARS.

The price to be paid for a mining location shall be at the rate of FIVE DOLLARS PER ACRE, cash, and the sum of FIFTY DOLLARS extra for the survey of the same.

No more than one mining location shall be granted to any individual claimant upon the same lode or vein.

IRON.

The Minister of the Interior may grant a location for the mining of iron, not exceeding 160 acres in area which shall be bounded by north and south and east and west lines astronomically, and its breadth shall equal its length. Provided that should any person making an application purporting to be for the purpose of

mining iron thus obtain, whether in good faith or fraudulently, possession of a valuable mineral deposit other than iron, his right in such deposit shall be restricted to the area prescribed by the Regulations for other minerals, and the rest of the location shall revert to the Crown for such disposition as the Minister may direct.

The regulations also provide for the manner in which land may be acquired for milling purposes, reduction works or other works incidental to mining operations.

Locations taken up prior to this date may, until the 1st of August, 1886, be re-marked and re-entered in conformity with the Regulations without payment of new fees, in cases where no existing interests would thereby be prejudicially affected.

PLACER MINING.

The Regulations laid down in respect to quartz mining shall be applicable to placer mining as far as they relate to entries, entry fees, assignments, marking of localities, agents' receipts, and generally where they can be applied.

The nature and size of placer mining claims are provided for in the Regulations, including bar, dry, bench, creek or hill diggings, and the RIGHTS AND DUTIES OF MINERS are fully set forth.

The Regulations apply also to

BED-ROCK FLUMES, DRAINAGE OF MINES AND DITCHES.

The GENERAL PROVISIONS of the Regulations include the interpretation of expressions used therein; how disputes shall be heard and adjudicated upon; under what circumstances miners shall be entitled to absent themselves from their locations or diggings, etc., etc.

THE SCHEDULE OF MINING REGULATIONS

Contains the forms to be observed in the drawing up of all documents such as:— "Application and affidavit of discoverer of quartz mine." "Receipt for fee paid by applicant for mining location." "Receipt for fee on extension of time for purchase of a mining location." "Patent of a mining location." "Certificate of the assignment of a mining location." "Application for grant for placer mining and affidavit of applicant." "Grant for placer mining." "Certificate of the assignment of a placer mining claim." "Grant to a bed rock flume company." "Grant for drainage." "Grant of right to divert water and construct ditches."

Since the publication, in 1884, of the Mining Regulations to govern the disposal of Dominion Mineral Lands the same have been carefully and thoroughly revised with a view to ensure ample protection to the public interests, and at the same time to encourage the prospector and miner in order that the mineral resources may be made valuable by development.

COPIES OF THE REGULATIONS MAY BE OBTAINED UPON APPLICATION TO THE DEPARTMENT OF THE INTERIOR.

A. M. BURGESS,

Deputy Minister of the Interior.

SEND FOR SAMPLES AND PRICES FOR

Asbestos Bags, Phosphate Bags, Ore Bags, &c.,

SPECIAL SIZES MADE TO ORDER.

DOUBLE SEWN.

DICK, RIDOUT & CO.,

PROPRIETORS TORONTO BAG WORKS,

Office and Warehouse: 11-13 Front St. East. Factory: 14, 16, 18, 20, 22 Bay St.

TORONTO.

ESTABLISHED 1878.

SHIPMAN ENGINES, ACME MODEL. COAL OIL FOR FUEL.



LAUNCH, MONTREAL.

To parties requiring a safe, reliable, durable and economical Steam Launch, from 20x4 to 35x7 with ample power to give satisfactory speed, we can supply the best on the market and at prices which will defy competition for a like quality of goods. We have a full staff of competent boat and engine builders and guarantee every article to be strictly first class. Hundreds of our engines from 1 to 12 h. p. Marine or Stationary have been in use for years and are acknowledged superior to all others. No smoke, dirt or sparks, no manual or mechanical labor necessary. You have the privacy of your launch for your family. As the water and oil supply is automatic very little attention is required. But a few minutes is necessary to get up 100 lbs. of steam; when you return to the boat house by turning a hand wheel all fire is extinguished. Orders for coming season should be placed at once, as the demand is much in excess of previous years. Write for 1889 circulars giving prices, testimonials, etc. No attention paid to postal cards.

JOHN GILLIES & CO., Carleton Place, Ont.

TO LET.



JOHN A. ROEBLING'S SONS CO. WIRE ROPE

—FOR—

Mines, Elevators, Inclines, &c.

GALVANIZED GUY ROPE. BRIDGE CABLES.
HAWSER ROPES.

WIRE of all kinds. Insulated WIRES

John A. Roebling's Sons Co.

117 & 119 LIBERTY St., NEW YORK.

H. L. SHIPPY Sec'y.

VALUABLE PLUMBAGO

AND OTHER

Mineral Lands FOR SALE,

IN THE TOWNSHIP OF BUCK-
INGHAM, COUNTY OF
OTTAWA.

1st.—Lot 28, in the 6th range, containing 100 acres, in addition to the salina of the lake.

2nd.—North half of lot 23, in the 5th range, containing 100 acres.

3rd.—Nine acres of lot No. 28, in the 5th range, with water privileges thereto appertaining, being site of mill dam, etc., etc.

The property formerly belonged to the Montreal Plumbago Mining Company, and was worked successfully for several years, until the company's mill was destroyed by fire, but the mill dam remains almost uninjured, and there are on the property several houses, sheds, etc., built for various purposes when mining operations were carried out.

The Plumbago Deposits

upon the property are regarded as amongst the richest and most extensive in the Dominion. As to the quality of the Plumbago, it has been extensively used in the manufacture of crucibles, lubricating leads, stove polish, etc., etc., and given unbounded satisfaction. This is established by the experience of consumers, and by a certificate from the celebrated Battersea Crucible Works, London, England, a copy of which is open for inspection.

MICA

has also been discovered in quantity.

The lands are in the Phosphate region, and recent prospecting has disclosed a rich and extensive deposit of this mineral. There are unrivalled facilities for transporting the ore to and from the mines by the Ottawa River and C. P. Railway. Distance from mines to Railway Station 6 miles. Good road.

All that is required to make these valuable mines handsomely remunerative is a little capital and enterprise.

The Title is Indisputable.

For information apply to

WM. H. DICKSON,
160 Waller St., Ottawa.

H. E. DICKSON,
Russell House, Ottawa.

OR TO THE OFFICE OF

THE CANADIAN MINING REVIEW
OTTAWA.



DEPARTMENT OF Inland Revenue.

AN ACT RESPECTING AGRICULTURAL FERTILIZERS.

The public is hereby notified that the provisions of the Act respecting Agricultural Fertilizers came into force on the 1st of January, 1886 and that all Fertilizers sold thereafter require to be sold subject to the conditions and restrictions therein contained—the main features of which are as follows:

The expression "fertilizer" means and includes all fertilizers which are sold at more than TEN DOLLARS per ton, and which contains ammonia, or its equivalent of nitrogen, or phosphoric acid.

Every manufacturer or importer of fertilizers for sale, shall, in the course of the month of January in each year, and before offering the same fertilizer for sale, transmit to the Minister of Inland Revenue, carriage paid, a sealed glass jar, containing at least two pounds of the fertilizer manufactured or imported by him, with the certificate of analysis of the same, together with an affidavit setting forth that each jar contains a fair average sample of the fertilizer manufactured or imported by him; and such sample shall be preserved by the

Minister of Inland Revenue for the purpose of comparison with any sample of fertilizer which is obtained in the course of the twelve months then next ensuing from such manufacturer or importer, or collected under the provisions of the Adulteration Act, or is transmitted to the chief analyst for analysis.

If the fertilizer is put up in packages, every such package intended for sale or distribution within Canada shall have the manufacturer's certificate of analysis placed upon or securely attached to each package by the manufacturer; if the fertilizer is in bags, it shall be distinctly stamped or printed upon each bag; if it is in barrels, it shall be either branded, stamped or printed upon the head of each barrel or distinctly printed upon good paper and securely pasted upon the head of each barrel, or upon a tag securely attached to the head of each barrel; if it is in bulk, the manufacturer's certificate shall be produced and a copy given to each purchaser.

No fertilizer shall be sold or offered or exposed for sale unless a certificate of analysis and sample of the same shall have been transmitted to the Minister of Inland Revenue and the provisions of the foregoing sub-section have been complied with.

Every person who sells or offers or exposes for sale any fertilizer, in respect of which the provisions of this Act have not been complied with—or who permits a certificate of analysis to be attached to any package, bag or barrel of such fertilizer, or to be produced to the inspectors to accompany the bill of inspection of such inspector, stating that the fertilizer contains a larger percentage of the constituents mentioned in sub-section No. 11 of the Act than is contained therein—or who sells, offers or exposes for sale any fertilizer purporting to have been inspected, and which does not contain the percentage of constituents mentioned in the next preceding section—or who sells or offers or exposes for sale any fertilizer which does not contain the per-

centage of constituents mentioned in the manufacturer's certificate accompanying the same, shall be liable in each case to a penalty not exceeding fifty dollars for the first offence, and for each subsequent offence to a penalty not exceeding one hundred dollars. Provided always that deficiency of one per centum of the ammonia, or its equivalent of nitrogen, or of the phosphoric acid, claimed to be contained, shall not be considered as evidence of fraudulent intent.

The Act passed in the forty-seventh year of Her Majesty's reign, chaptered thirty-seven and entitled, "*An Act to prevent fraud in the manufacture and sale of agricultural fertilizers*," is by this Act repealed, except in regard to any offence committed against it or any prosecution or other act commenced and not concluded or completed, and any payment of money due in respect of any provision thereof.

A copy of the Act may be obtained upon application to the Department of Inland Revenue, as well as a copy of a Bulletin which it is proposed to issue in April, 1888, concerning the fertilizers

E. MIALL,
Commissioner.

January, 1889.

PROPERTIES FOR SALE.

Parties having developed or undeveloped mineral lands for sale will find the REVIEW an admirable medium for bringing them before the notice of CAPITALISTS and INVESTORS in GREAT BRITAIN and the UNITED STATES.



THE Intercolonial Railway

OF CANADA.

The Royal Mail Passenger & Freight
Route between Canada and
Great Britain,

—AND—

Direct route between the West and all points on the Lower St. Lawrence and Baie des Chaleurs; also New Brunswick, Nova Scotia, Prince Edward Island, Cape Breton and Newfoundland.

New and Elegant Buffet Sleeping and Day Cars on through Express Trains.

Passengers for Great Britain or the Continent by leaving Toronto by 8 00 A.M. train Thursday will join Outward Mail Steamer at Halifax Saturday.

Superior Elevator, Warehouse and Dock accommodation at Halifax for shipment of grain and general merchandise.

Years of experience have proved the Intercolonial, in connection with steamship lines to and from London, Liverpool and Glasgow to Halifax, to be the quickest freight route between Canada and Great Britain.

Information as to Passenger and Freight rates can be had on application to

E. KING,
27 Sparks Street,
OTTAWA.

G. W. ROBINSON,
Eastern Passenger Freight Agent,
137½ St. James St., MONTREAL.

D. POTTINGER,
Chief Superintendent.

Railway Offices, Moncton, N.B.
Nov. 20th, 1888.

The Polson Iron Works Co'y TORONTO, ONT.

Manufacturers of the Celebrated "Brown
Automatic Engine"

GENERAL DEALERS IN

MINING MACHINERY.

SPECIAL AGENTS FOR

Knowles' Steam Pumps,

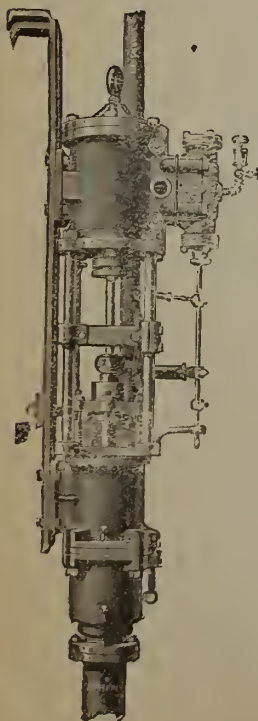
B. T. Sturtevant's Blowers and Fans,

Burleigh Rock Drills.

Hoisting Engines and Boilers, Quartz Mills, Diamond Prospecting Drills, Rock Breakers.

Office and Works, Esplanade E.; Warehouse, 38 Yonge St.,

TORONTO.

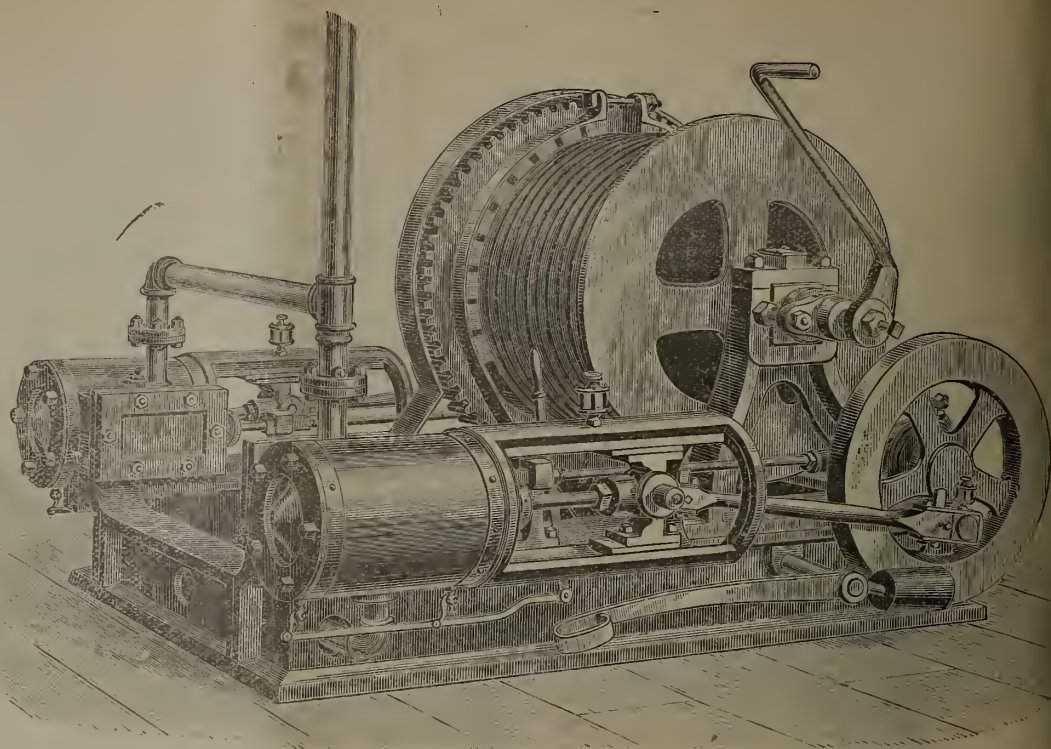


JOHN DOTY ENGINE CO.

Toronto, Ont.

MANUFACTURERS OF

Mining & General
Machinery.



HOISTING ENGINES

—: FOR :—

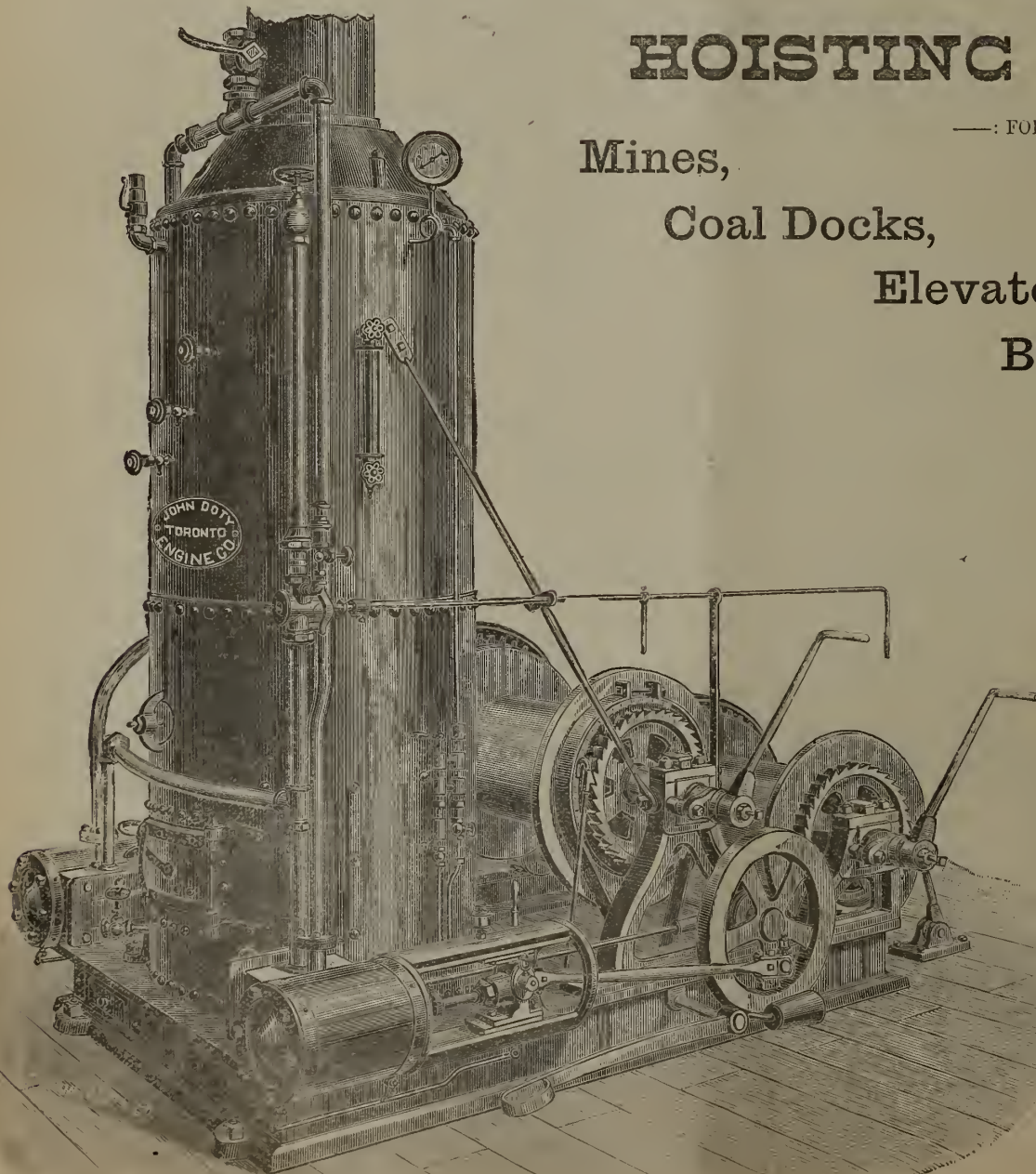
Mines,

Coal Docks,

Elevators,

Bridge Builders,

Contractors, &c.



CORLISS ENGINES

Tug & Steam Yacht Engines,

Mill Engines.

Shafting & Mill
Gearing.

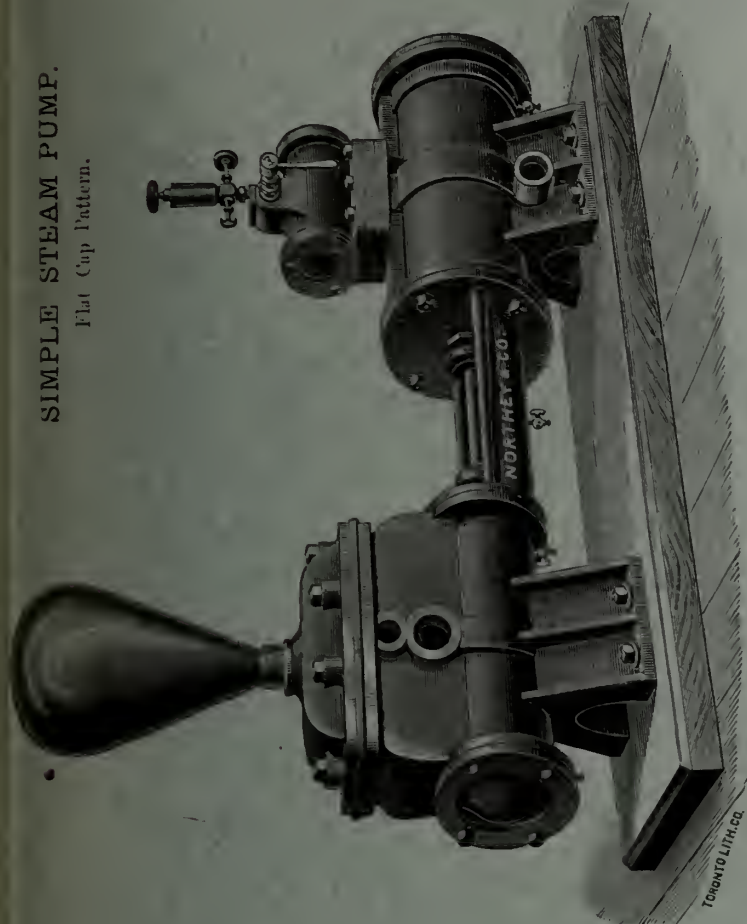
All Descriptions of Boiler
and Tank Work.

Send for Estimates and
Catalogues.

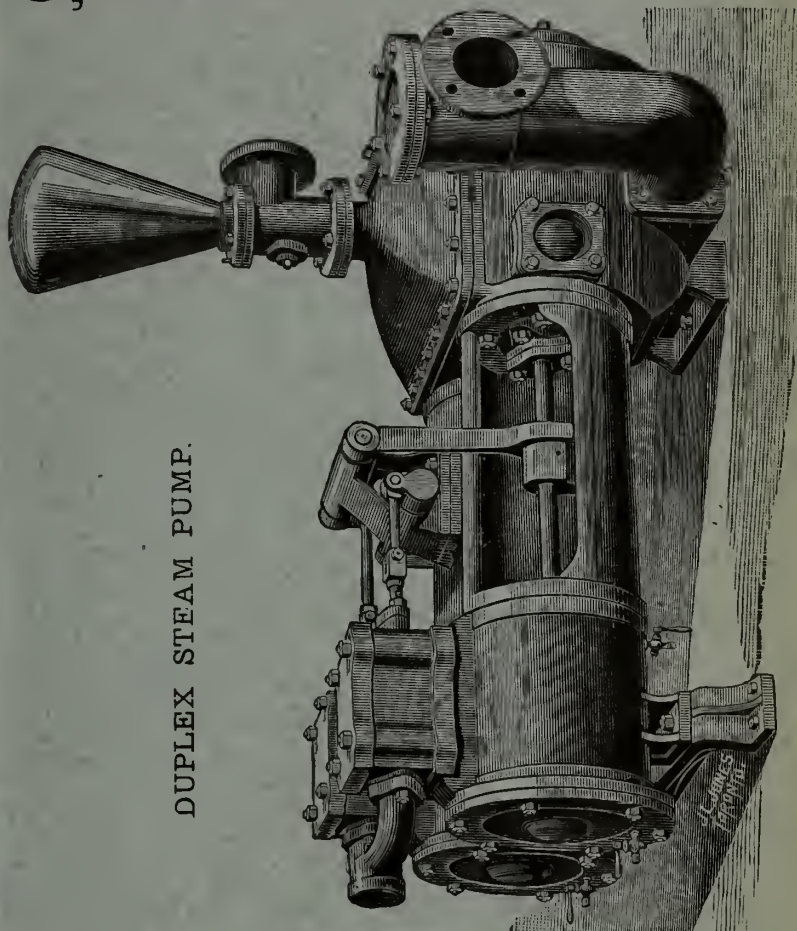
Northey & Co's Steam Pump Works, TORONTO, ONT.

SIMPLE STEAM PUMP.

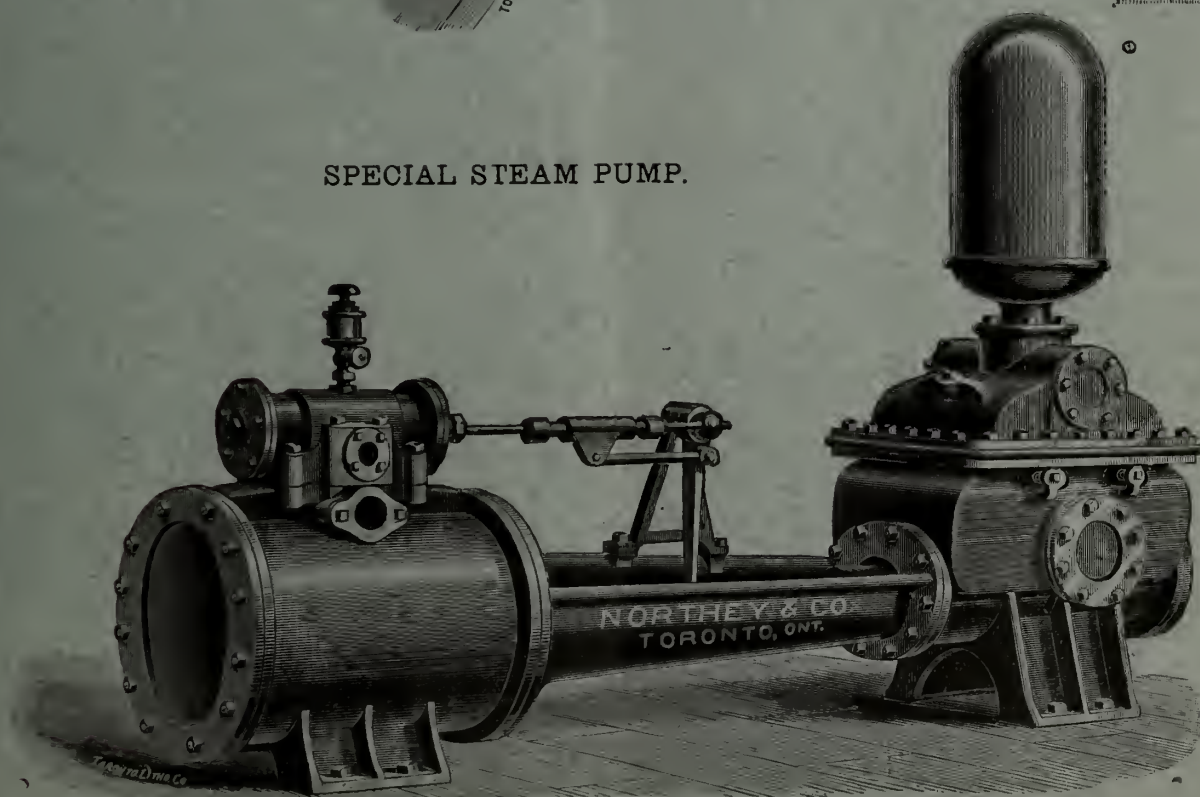
Flat Cup Pattern.



DUPLEX STEAM PUMP.



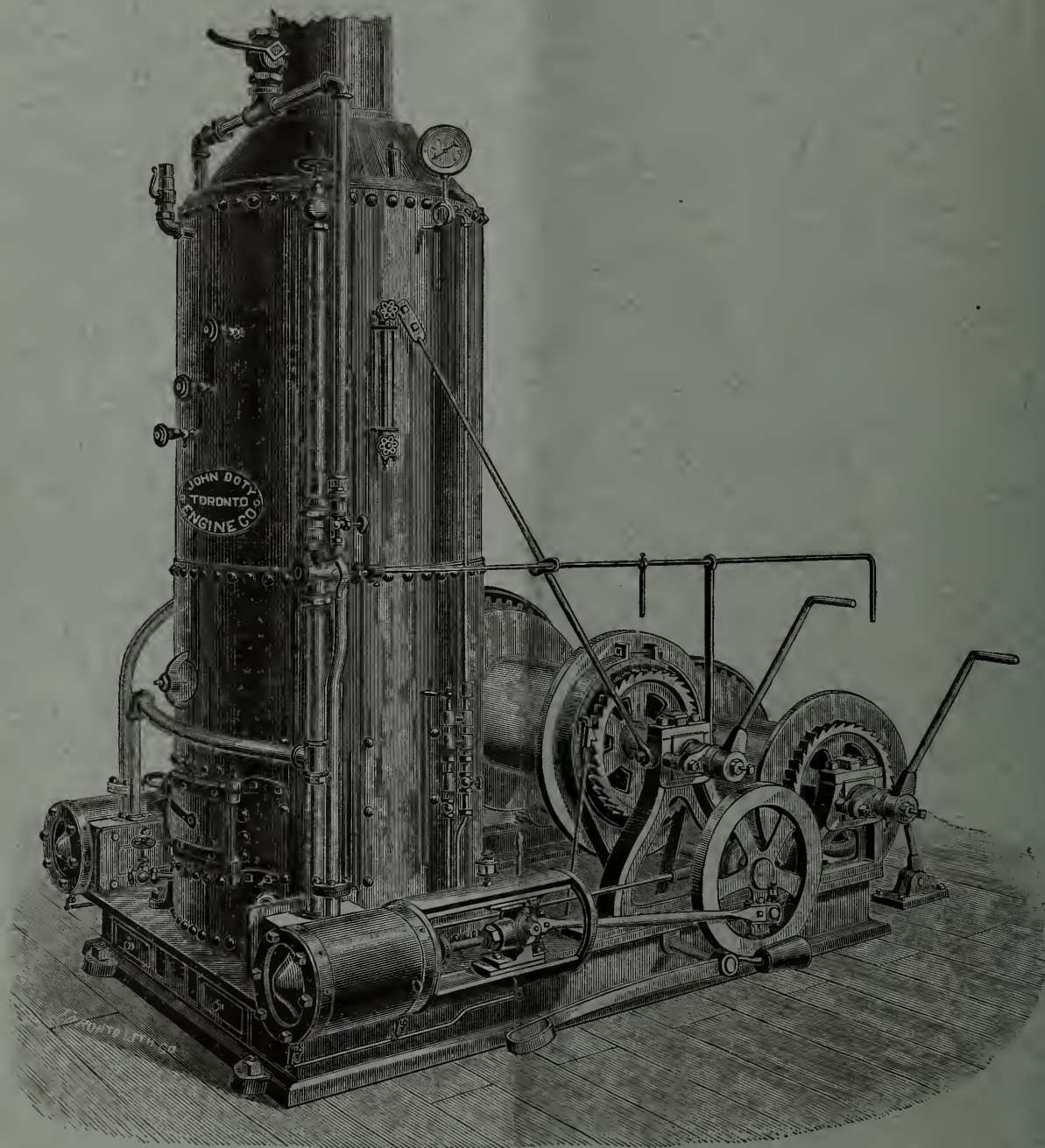
SPECIAL STEAM PUMP.



Steam Pumps of the best and latest designs for mining purposes, Boiler Feeding, Fire Protection, and General Water Supply, etc.

NORTHEY & CO.,
Mechanical  Hydraulic Engineers,    Toronto, Ont.
WORKS—COR. FRONT AND PARLIAMENT STS.

A. R. WILLIAMS,
SOHO MACHINE WORKS,
TORONTO, ONTARIO.
MANUFACTURER AND DEALER IN
MACHINERY AND SUPPLIES.



Duplex Steam Pumps, all sizes. Every Pump Guaranteed.
VERY LOW PRICES.

• Portable Engines, Hoisting Engines, Stationary Engines, Iron and Wood Working Machinery, Ventilating Fans, Saw Mill and Shingle Mill Machinery. Full lines of Machinery and Supplies. Send for Catalogue.

MINING REVIEW

Canadian

Established 1882

Vol. VIII.—No. 6.

1889.—OTTAWA, JUNE—1889.

Vol. VIII.—No. 6.

1889 CATALOGUE OF 200 PAGES, 1889

This Catalogue is one of unusual interest and value.—*R.R. Gazette*.
Should be in the hands of every engineer and Contractor.—*Eng. and Min. Journal*.
Applies a long felt want.—*Manufacturers Record*.
This is a thoroughly good publication.—*Engineering News*.
A valuable addition to the literature on the subject.—*Eng and B'g Record*.
The matter is readily available.—*Tradesman*.
Complete Work.—*Colliery Engineer*.
Handy for reference.—*Min. and Sc. Press*.
The useful information will be specially valuable.—*Eng. and B'g Record*.
Really a hand book.—*Am. Manufacturer*.

RAND DRILL CO.,
23 PARK PLACE, NEW YORK.

Hamilton Powder

COMPANY,

Manufacture Mining, Blasting, Military
and Sporting

Gunpowder,

DYNAMITE, DAULIN, and the new

ECLIPSE MINING POWDER

DOMINION AGENTS FOR

Safety Fuse, Electric Blasting
Apparatus, &c.

OFFICE

103 ST. FRANCOIS XAVIER STREET
MONTREAL.

BRANCH OFFICES & MAGAZINES
at all chief distributing points
in Canada.

CANADA ATLANTIC
RAILWAY.

THE SHORTEST PASSENGER ROUTE
BETWEEN

Ottawa and Montreal,
AND ALL POINTS EAST & SOUTH.

The only road in Canada running trains lighted
with electricity and heated by steam from the
engine. Luxurious Buffet Pullman Palace Cars
on all trains between Ottawa and Montreal. Only
line running through Sleeping Cars between

Ottawa, Boston and New York

And all New England and New York points.

Passage checked to all points and passed by Customs in transit.

During season of navigation close connections
are made with Richelieu and Ontario Navigation
Company's Steamers at Coteau Landing, shooting
the St. Lawrence Rapids.

For Tickets, Time Tables and information apply
to nearest agent, or to

S. EBBS, City Passenger Agent,
24 Sparks St., OTTAWA.

GEO. H. PHILLIPS, Gen. Agent,
VALLEYFIELD.

A. E. CAIRNS, General Agent,
136 St. James St., MONTREAL.

Or at 260 Washington St., Boston, and
317 Broadway, New York.

PERCY R. TODD,
General Passenger Agent.

E. J. CHAMBERLAN,
General Manager,
General Offices, Ottawa.

THE CANADIAN RUBBER CO.
OF MONTREAL.

A. ALLAN, Pres.

J. O. GRAVEL, Secy. & Treas.

F. SCHOLLES, M'g. Dir.

Manufacturers of

**SUPERIOR QUALITY
RUBBER GOODS.**

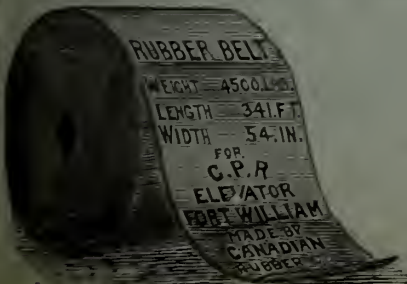
Our Rubber Belting is Un-
equalled in America.

Rubber Packings of all kinds.

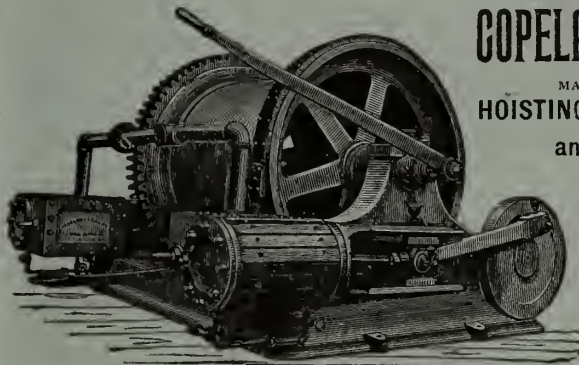
Rubber Engine, Hydrant, Suction,
Steam, Brewers' and Fire Hose.

Moulded Goods of every description.

J. H. WALKER, Manager.



Western Branch cor. Front and Yonge Sts.,
TORONTO.



COPELAND & BACON

MANUFACTURERS OF
HOISTING ENGINES,
and MINING PLANTS.

85 Liberty St.
NEW YORK.

Send for Catalogue.

MILLER BROS. & MITCHELL

MANUFACTURERS OF

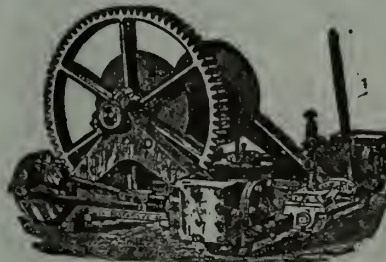
Steam Rock Drills

AND

HOISTING ENGINES,

Mining & Contractors' Plant
&c., &c.

110 TO 120 KING STREET, MONTREAL, QUE.



THE

BELL TELEPHONE CO.

OF CANADA.

ANDREW ROBERTSON, - - - PRESIDENT

C. F. SISE, - - - VICE-PRESIDENT

C. P. SCLATER, - - - SECRETARY-TREASURER

HEAD OFFICE, - MONTREAL.

H. C. BAKER, Manager Ontario Department,
HAMILTON.

This Company will sell its instruments at prices
ranging from \$10 to \$25 per set. These instru-
ments are under the protection of the Company's
patents, and purchasers are therefore entirely free
from risk of litigation.

This Company will arrange to connect places
not having telegraphic facilities with the nearest
telegraph office, or it will build private lines for
firms or individuals, connecting their places of
business or residences. It is also prepared to
manufacture all kinds of electrical apparatus.

Full particulars can be obtained at the Com-
pany's offices as above, or at St. John, N.B., Hal-
ifax, N.S., Winnipeg, Man., Victoria, B.C.



MISS M. E. ORR.

REMINGTON

STANDARD

TYPEWRITER

Miss Orr, Championship
of the world and Gold Medal
at Toronto, 13th August,
1888.

GEORGE BENGOUGH,

GENERAL AGENT,

36 King Street, TORONTO.

AEX. FLECK, JUN.,

Manufacturer of every Description of

Mill Machinery

Water Wheels, Steam Engines,
Boilers, Derricks, Steam
Pumps and Mining
Machinery.

Brass and Iron Casting of every
Description.

VULCAN IRON WORKS, WELLINGTON ST.
OTTAWA.

DYNAMO ELECTRIC

MACHINES and LAMPS



ARC and INCANDESCENT

FOR MINING PURPOSES

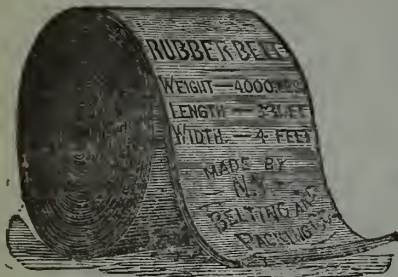
New York Belting & Packing Co.

15 PARK ROW, NEW YORK

JOHN H. CHEEVER, Treasurer.

J. D. CHEEVER, Dep'y Treasurer.

Oldest and largest Manufacturers in the United States of

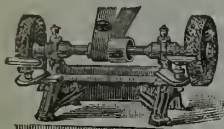


RUBBER BELTING.

CIRCULAR WOVEN SEAMLESS, ANTI-SEPTIC RUBBER LINED

"CABLE" HOSE and TEST HOSE

For the use of Steam Engines, Force Pumps, Rolling Mills, Iron Works, Factories, etc. Woven in a superior manner to insure wear, compactness and durability.



Emery Vulcanite Wheel.

SOLID VULCANITE
EMERY WHEELS

(Large Wheels made on iron centers)

Cuts Cooler and Freer than any other other wheel in the market.

W. D. ALLEN & CO.,
151 Lake St., Chicago.

H. D. EDWARDS & CO.,
Detroit.

European Branch: Pickhuben, , Hamburg Freihafengebeit),Germany.

**VULCANIZED
RUBBER FABRICS**

FOR MECHANICAL PURPOSES.

**EXTRA RUBBER BELTING
AND HOSE**

FOR MINING PURPOSES.



"TEST HOSE."

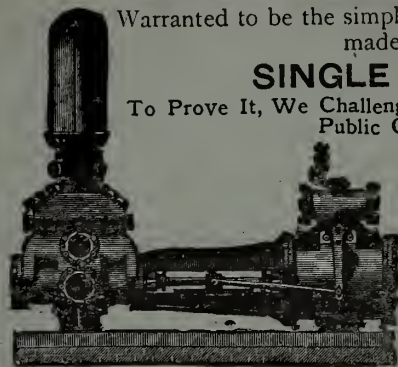
The M. T. DAVIDSON

IMPROVED MINING PUMP.

Warranted to be the simplest and most efficient Steam Pump made, whether it be

SINGLE OR DUPLEX.

To Prove It, We Challenge All Makers of Steam Pumps to a Public Competitive Test.



COMPOUND PUMPING ENGINES,

Obtaining a higher duty than any direct-acting pump made.

MANUFACTURED BY THE

**Davidson Steam Pump
COMPANY,**

New York Office, - - - 77 Liberty Street.

ROOT'S

SPIRAL RIVETED PIPE

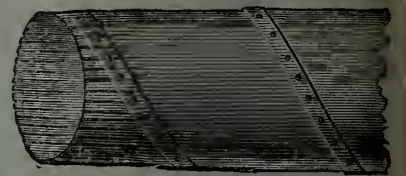
FOR

Hydraulic Mining,

Water Works

Ranch and Railroad

Water Supplies.



From 2 to 24 inches in diameter and 1 to 25 in length. Manufactured with fittings to suit, capable of withstanding any desired pressure.

ABENDROTH & ROOT MFG. CO.

28 Cliff Street, New York.

Chicago Branch, - - SMITH & KNAPP, 62 South Canal Street

LIDGERWOOD MANUF'G CO.

96 LIBERTY ST, NEW YORK,

Largest Manufacturers in the United States of Hoisting Machinery of Every Description for Mines, Tunnel Work, Contractors, and General Hoisting Purposes.

IMPROVED HOISTING ENGINES

FOR MINING PURPOSES A SPECIALTY.

Over 5,000 Engines in Use!

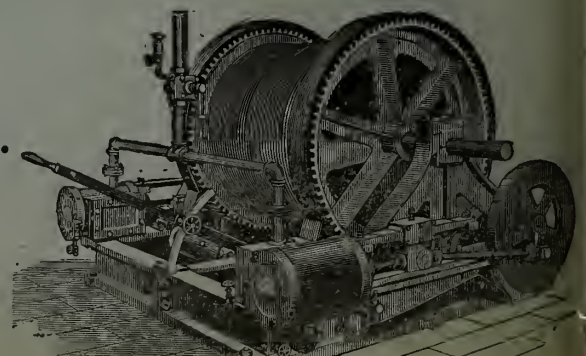
300 Styles

and Sizes.

Send for
CATALOGUE.



FRICION DRUM PORTABLE HOISTING ENGINE.

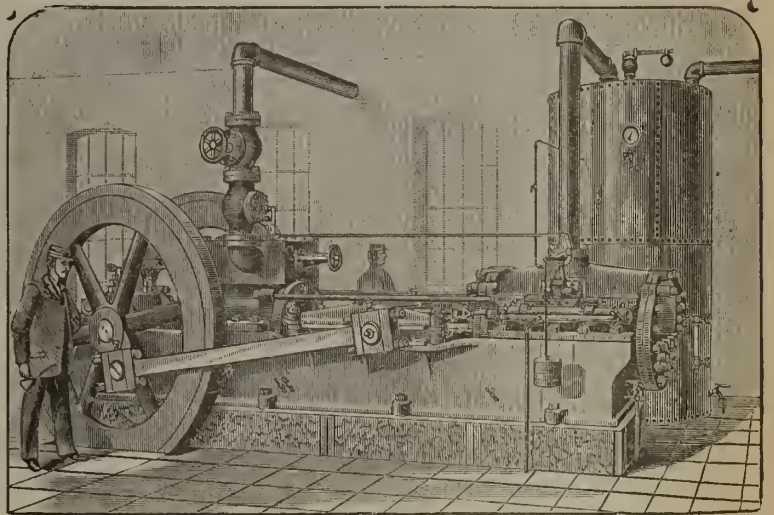


Double Cylinder Reversible Mine Engine.

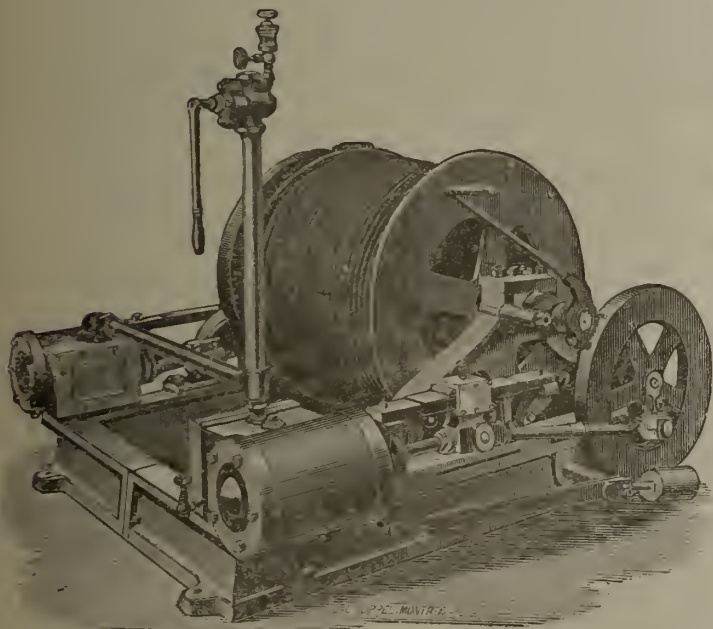


INGERSOLL
ROCK DRILL COMP'Y
OF CANADA
MANUFACTURERS OF

Rock Drills,
Air Compressors,
Steam & Horse Power Hoists,
BOILERS,
—AND—
GENERAL MINING
—AND—
Quarrying Machinery
—AND—
Contractors' Plant.



—ALSO—



Drill Steel, Wire Rope,
Derrick Castings,
Steam & Air Hose & Couplings,
Iron Piping, Fittings,
—AND—
ALL KINDS OF SUPPLIES
—FOR—
Miners & Contractors' Work.

For Estimates, Catalogues and information address

Ingersoll Rock Drill Co. of Canada

204 st. James street, or P.O. Box 1942, Montreal.

F. G. BECKETT ENGINE CO

HAMILTON, ONT.



Having had many years practical experience in the manufacture of

MINING MACHINERY

IS NOW PREPARED TO CONTRACT FOR

Stamp Mill Machinery,
Concentration Mills,
Revolving, Roasting and
Drying Furnaces
Rock Breakers,
Cornish Rolls for crushing,
Amalgamating Pans and Settlers,
Concentrators and
Revolving Screens,
Smelting Furnaces, Retorts,

HOISTING ENGINES,

EITHER GEARED OR DIRECT ACTION.

Cornish Pumping Machinery,
Iron Ore Cars, Safety Cages, &c.,
Rock Drills and Air Compressors.

STEAM ENGINES AND BOILERS.

Marine Engines and Steam Yachts.

Francis D. Taylor
MINING ENGINEER,
ROCKVILLE, - ONTARIO

SPECIALTY. — The Mining of Iron Ores,
and the Manufacture of Iron and Steel.
Mr. T. has had for many years the manage-
ment of large mining enterprises in England
and the U. S. A.

CAMERON STEAM PUMP
SIMPLE, RELIABLE, COMPACT, DURABLE.
NO OUTSIDE VALVE GEAR.
THE A.S. CAMERON STEAM PUMP WORKS.
ADAPTED FOR ALL PURPOSES.
FOOT OF EAST 23rd STREET, NEW YORK.



PHOSPHATE LANDS.

South half Lot 10, 9th Range, Buckingham, or the
Mines thereon, will be sold out and cheap for cash.
One mile from the River, five from Buckingham Village.
Good roads; three good "Shows" and several smaller
ones.

Apply to
S. J. JONES, Buckingham
OR ON THE PREMISES.

TAYLOR McVEITY,
Barrister, Solicitor, &c.,

Supreme Court and Departmental Agent,
SCOTTISH ONTARIO CHAMBERS, OTTAWA.

WM. HAMILTON MERRITT, F.C.S.

Associate Royal School of Mines, &c.,
Mining Engineer and Metallurgist,
Will report on Mines and Mineral Properties.

ADDRESS:
15 TORONTO ST., TORONTO, ONT.

J. T. DONALD, M.A.,

Analytical Chemist and Assayer,
124 ST. JAMES ST. - MONTREAL.
Analyses and Assays of every description. Manufactur-
ing processes practically tested. Laboratory instruction
in Chemistry, Assaying and Mineralogy. Terms on
application.

THE DOMINION
Leather Board Co.

MONTREAL,

— MANUFACTURERS OF —

Leather Board & Stiffeners

ALSO OF

ASBESTOS MILL BOARD,

STEAM PACKING, and

FRICTION PULLEY BOARD.

Samples and prices furnished upon ap-
plication.

Please mention this paper.



ONTARIO

Mining Regulations.

The following summary of the principal
provisions of the General Mining Act of
the Province of Ontario is published for
the information of those interested in
mining matters in the Algoma District,
and that part of the Nipissing District
north of the Mattawan River, Lake Nipis-
sing and French River.

Any person or persons may explore for
mines or minerals on any Crown Lands
surveyed or unsurveyed, not marked or
staked out or occupied.

The price of all lands sold as mining
locations or as lots in surveyed townships
is two dollars per acre cash, the pine timber
being reserved to the Crown. Patentees
or those claiming under them may cut and
use such trees as may be necessary for
building, fencing or fuel, or for any other
purpose essential to the working of mines.

Mining locations in unsurveyed territory
shall be rectangular in shape, and the
bearings of the outlines thereof shall be due
north and south, and due east and west
astronomically, and such locations shall be
one of the following dimensions, viz: eighty
chains in length by forty chains in width,
containing 320 acres, or forty chains square,
containing 160 acres, or forty chains in
length by twenty chains in width, con-
taining 80 acres.

All such locations must be surveyed by
a Provincial Land Surveyor, and be con-
nected with some known point or boundary
at the cost of the applicant, who must file
with application surveyor's plan, field notes
and description of location applied for.

In all patents for mining locations a
reservation of five per cent. of the acreage
is made for roads.

Lands patented under the Mining Act
are free from all royalties or duties in re-
spect to any ores or minerals thereon, and
no reservation or exception of any mineral
is made in the patents.

Lands situated south of the Mattawan
River, Lake Nipissing and French River
are sold under the Mining Act at one
dollar per acre cash.

Affidavits showing no adverse occupa-
tion, improvement or claim should ac-
company applications to purchase.

A. S. HARDY,

Commissioner,

Department of Crown Lands, Toronto.

The Canada Co.

Will issue Licences to Prospect or
to work Minerals on any of
their Mining Lands and
Mineral Reservations,

Covering nearly a

Quarter of a Million Acres

In Eastern Ontario, and principally
within the belts containing

Iron, Phosphate, Gold, Galena
Plumbago, Mica, Marbles,
Building Stone,
and other valuable Minerals.

For list of lands and terms apply to the
Company's Mining Inspectors,

H. T. STRICKLAND,
Peterborough, Ont.,

or lands in the County of Hastings and
westward, and to

ANDREW BELL, P.L.S.,
Almonte, Ont.,

or lands East of the County of Hastings.

FENWICK & SCLATER,

Manufacturers of Asbestos, Fire Hose, Files and Cotton
Waste, Miners of Asbestos and Soapstone,

ASBESTOS

Cotton, Leather and Rubber Belting,

42, 44 & 46 Foundling Street, Montreal.

H. R. IVES & CO.,

Hardware Manufacturers and Founders,
QUEEN ST., MONTREAL.

STOVES.	PORTABLE	MONTREAL	CASTINGS
TRADE MARK "Buffalo"	FORGES.	SMELTING CO'S	Of every description
IRON	BLACKSMITH'S	BABBIT	to order.
BEDSTEADS	DRILLS.	METAL.	SOIL PIPE.
FOR MINERS' USE.			

PORTABLE ENGINES AND SAW-MILLS

Of all capacities—from 3000 feet of lumber and up per day.

Saw-Mills.

Shingle-Mills.

Lath-Mills.

Chopping-Mills.

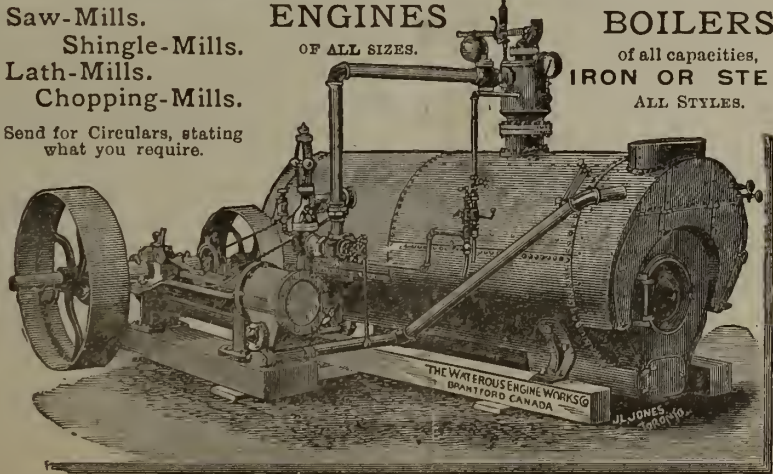
ENGINES

OF ALL SIZES.

BOILERS

of all capacities,
IRON OR STEEL,
ALL STYLES.

Send for Circulars, stating
what you require.



Waterous Engine Works Co. Brantford, Canada.
St. Paul, Minn., U.S.A.

TO MINERS AND OTHERS.

Bannerman & Powers,

VULCAN BOILER WORKS,

428 and 340 Wellington St., Ottawa.

MANUFACTURERS OF

IRON AND STEEL BOILERS

OF EVERY DESCRIPTION.

Tanks, Girders, Iron Roof-
ing, Bank Vaults, Smoke
Stacks

— AND ALL KINDS OF —

SHEET IRON WORK.

Repairs Neatly and Promptly Executed

JOHN E. HARDMAN, S.B.
MINING ENGINEER,
OLDHAM, NOVA SCOTIA.

Can be consulted on all matters pertaining to the profession.

The development and management of Gold Properties a specialty.

WILSON & GREEN,
Commission Merchants,
PHOSPHATE SHIPPERS.
AGENTS HIGH ROCK MINE.
30 St. François Xavier St., - MONTREAL.

EDMUND SPARGO,
Consulting and Mining Engineer, 3 Cable Street,
Liverpool.

Owners of or Investors in Metalliferous Mines, Slate, Granite, and other Stone Quarries, Brick, Terra Cotta, Fire and other Clays and Mineral Estates in general, requiring reliable and sound advice either in the Purchase or Disposal thereof, should consult E.S., who has executed important professional Commissions in Germany, Austria, Hungary, France, Belgium, Spain, Portugal, Sweden, Norway, and in the various Mining Districts throughout Great Britain and Ireland. Telegraphic Address: "Spargo," Liverpool. Bankers, National Provincial Bank of England, Liverpool.

THOMAS HEYS,
Analytical and Consulting Chemist and Assayer.
References are kindly permitted by the following:
Messrs. Gooderham & Worts, Toronto, Limited; Messrs. P. R. Lamb & Co.; John Livingston, Esq., Dominion Bolt Co.
Assay and Analytical Laboratory
16 King St. West, opposite the Rossin House, } **TORONTO.**

J. LAINSON WILLS,
F. C. S., ETC.
Late Manager Canadian Phosphate Co. (Lim.),
Will shortly be disengaged, and offers his services to examine and report upon Mines and Mining properties. Advice given on Chemical and Metallurgical processes.
SPECIALTIES: PHOSPHATE AND GOLD.
TELEGRAPHIC OR POSTAL ADDRESS:
WILLS, BUCKINGHAM, P.Q.

Irwin, Hopper & Co.
MINERS AND SHIPPERS OF
MINERALS,
30 St. François Xavier Street,
MONTREAL, CAN.
Asbestos, crude and manufactured. Phosphate, Mica, Plumbago, Soapstone, &c.

DOMINION ASSAY OFFICE,
Gold and Silver Ores and Bullion
ASSAYED, REFINED AND PURCHASED.
Mining Properties bought sold and examined. Fifteen years experience in Australia, New Zealand and California.
44 VICTORIA STREET, - - - TORONTO.
H. ANN, PROP.

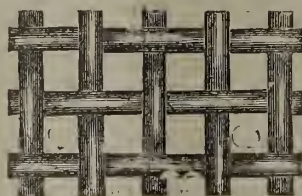
JAMES HOPE & CO.,
BOOKSELLERS,
Stationers, Bookbinders and Printers,
OTTAWA.

SPEIGHT & VanNOSTRAND,
Dominion and Provincial Land Surveyors,
Draughtsmen, Valuers, &c.
OFFICE: ROOM "J," FIRST FLOOR, TORONTO ARCADE,
YONGE ST., TORONTO.
Surveys, Plans, Descriptions of Properties, etc., promptly executed.
Timber Limits and Mining Claims Located.

MILLAR & CO.
General Merchants & Shipping Agents
ATLANTIC CHAMBERS,
209 COMMISSIONER ST., - MONTREAL
Cable address, "Hoyer, Montreal." P.O. Box 1095.
AGENT FOR The Canadian Phosphate Co., Ltd., of London, Eng.,
The Montreal Union Abattoir Co., of Montreal, Can.
English Correspondents Messrs. Couper, Millan & Co., London, England.



For Mining Hoisting Derricks, etc.



Strong Wire Cloth and Screens
For Mining, etc., manufactured by
B. Greening & Co.
HAMILTON, ONT.

NATIONAL COLONIZATION
Lottery!
UNDER THE PATRONAGE OF
THE REV. FATHER LABELLE.

Established in 1884 under the Act of Quebec, 31 Vict.,
Chap. 36, for the benefit of the Diocesan Societies
of Colonization of the Province of Quebec.

CLASS D.
DRAWINGS ON THIRD WEDNESDAY IN EVERY
MONTH AT 2 P.M.

Prizes value \$50,000
Capital Prize: 1 Real Estate worth \$5,000.

LIST OF PRIZES.

1 Real Estate worth	\$5,000	\$5,000
1 Real Estate worth	2,000	2,000
1 Real Estate worth	1,000	1,000
4 Real Estates	500	2,000
10 Real Estates	300	3,000
30 Furniture Sets	200	6,000
60 Furniture Sets	100	6,000
200 Gold Watches	50	10,000
1000 Silver Watches	10	10,000
1000 Toilet Sets	5	5,000

2307 Prizes worth..... \$50,000
Tickets, \$1.00!

Offers are made to all winners to pay their prizes cash, less a commission of 10 p. c. Winners' names not published unless specially authorized.
S. E. LEFEBVRE, Secretary
Office: 19 St. James St., Montreal, Can.

W. Blakemore, F.G.S., M.E.,
Member of I. & S.I. | A. Montgomery Evans, M.E.
of Canada & U.S.
BLAKEMORE & EVANS,
MINING & CIVIL ENGINEERS
Exchange Buildings, Cardiff, S. W.

LONDON OFFICE:
Robert H. Jones, 82 Queen St., Cheapside, London, E.C.
Reports, Estimates, and Valuations made on Iron and Steel Works,
Blast Furnaces, and all classes of Mining Properties.
CANADIAN BUSINESS PROMPTLY ATTENDED TO.

To Prevent Boiler Explosions
And other accidents to steam boilers, and to secure
economy in working, insure with
THE BOILER INSPECTION
AND INSURANCE COMPANY OF CANADA.

Sir Alex. Campbell, K.C.M.G., | John L. Blaikie, Esq.
President. Vice-Pres.
HEAD OFFICE: - - - - - TORONTO
G. C. ROBB, Chief Engineer.
A. FRASER, Sec'y-Treas.

ORFORD COPPER CO.,
COPPER SMELTERS.
Works at Constable's Hook, N.J., opposite new Brighton, Staten Island. Copper Ore, Mattes, or Bullion purchased. Advances made on consignments for refining and sale. Specialty made of Silver-Bearing Ores and Mattes.
SELL
INGOT AND CAKE COPPER.
President, **ROBERT M. THOMPSON,**
Treasurer, **G. A. LAND.**
Office, 37 to 39 Wall Street, New York.

Robin & Sadler,
MANUFACTURERS OF
LEATHER BELTING.

TRY OUR
Waterproof Belting,
Just the thing for Mining Machinery.
MONTREAL, TORONTO,
2518, 2520, 2522 Notre Dame St. 129 Bay Street.

Diamonds, Jewelry, Watches & Silverware
AT ROSENTHAL'S
Goldsmith's Hall, 87 Sparks St.
OTTAWA.

T. D. LEDYARD,
DEALER IN MINERAL LANDS
4 ONTARIO CHAMBERS, TORONTO.
Will buy undeveloped iron ore and other mineral properties.
WANTED. — Deposits of Magnetic Iron Ore, Red Hematite, Brown Hematite, Galena, Iron and Copper Pyrites, Mica, Soapstone, Marble, Gypsum, Baryta. Samples can be sent by Sample Post for 1 cent for 4 oz. or up to 24 oz. in weight.
Information regarding mines cheerfully given. Correspondence solicited. Crown Land Business attended to.

CHEMICAL APPARATUS! OF EVERY DESCRIPTION.



Glass, Porcelain, Stoneware, Platinum Crucibles of every sort, Analytical Scales and Weights, Fine Chemicals and Reagents, including Volumetric Solutions. Every requisite for Analysis or Experiment. For Sale by

LYMAN, SONS & CO.,
384 St. Paul St., Montreal.

Illustrated Catalogue mailed on receipt of 10c. or Business Card.

Boiler For Sale.

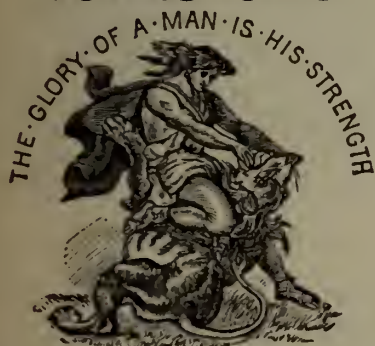
A N EIGHTY H.P. TUBULAR STEEL BOILER made by W. C. White, Montreal, 15 ft. x 5 ft. 4 in. —eighty 3½ in. tubes; smoke stack 45 ft. long; guylards and guys. Very little used. Equal to new. Price on cars, \$600. Address

P. O. Box 6,
MONTREAL.

IMPROVE YOUR HEALTH

And INCREASE your MUSCULAR DEVELOPMENT
By taking REGULARLY

JOHNSTON'S



FLUID BEEF.

The most strength-giving food for
YOUNG or OLD or for the SICK or HEALTHY.

Victor Electric Fuses.

Superior to all others for Exploding any make of Dynamite, High Explosives, or Gelatine Powder. Each Fuse is tested and warranted extra strong and waterproof. Low grades of Dynamite Powder will do ten per cent. more execution if detonated with Victor Electric Fuses.

VICTOR BLASTING MACHINES.

Latest improvements, made in three sizes, easy to operate, strong and durable. No expensive repairs, low in price, will fire any make of Electric Fuses.

MANUFACTURED ONLY BY

JAMES MACBETH & CO.,

128 Maiden Lane, N.Y., U.S.A.

Send for Catalogue.

FOR SALE.

A COAL MINE IN CAPE BRETON,

Area, 970 acres, underlaid by 6 or 7 beds of the best Coal in Nova Scotia. The property is estimated to contain from 50 to 60 million tons of Coal. No Coal Mine can be more easily or cheaply operated. The angle of dip is 6 degrees, and the rock stratification is remarkably even and without fault or break.

Apply to

ALEXANDER CAMPBELL,
Annapolis Royal, N.S.

JOHN D. FROSSARD, B.S., M.E.

MINING ENGINEER & GEOLOGIST,

30 St. Francois Xavier St., - - Montreal.

Specialty—Phosphate Lands.

LEDoux & COMPANY,

10 CEDAR ST., NEW YORK.

Engineers, Metallurgists &
Assayers.

Public Ore Sampling & Storage Works

All the principal buyers of furnace materials in the world purchase and pay cash against our certificates of assay, through New York banks.

By special permission of the Secretary of the Treasury of the United States, cars of ore or copper matte passing through in bond can be opened and sampled at our works.

Consignments received and sold to highest bidder. Send for circular giving full particulars.

Mines examined and sampled. Assays and Analyses of all kinds.

A Remarkable Hoisting Record—On March 26th the J shaft of the Chicago, Wilmington, and Vermilion Coal Company, at Braidwood, Illinois, hoisted 1,655 tons of coal in 9½ hours. This, while the best hoisting record yet made, is said to be not the maximum, and it is expected to run this up to 2,000 tons in the near future. The J shaft is 92 feet from the surface to the coal, and it was sunk in 17 shifts in 1885. There are 200 rooms in it and about 700 miners are employed. The shaft is equipped with Cherry's self-dumping cages, and Ramsay's box-car trimmer. The cages are raised and lowered by a double hoisting-engine with 14-inch cylinders, 18-inch stroke, geared to a drum 6 feet in diameter. The following is a detailed statement of the work done: Average weight of pit cars, 1,408 lbs. Tons per hour 174.22. Tons per minute, 2.90. Pit cars per minute, 4.12. Miles run by cages 106.62. This shows that to hoist 1,655 tons nearly 2,350 mine-cars were hoisted.

A New Use For Graphite.—A new use of Graphite consists in its application to wire rope. Wire rope is expensive, and is rapidly coming into a much larger consumption. It is largely used in distant fields and mines, where break-ages cost double and treble the usual expense of repair, so that a wire rope preservative is literally a boon. This is found in Graphite. The Graphite must be pure and only the flake is useful. This graphite is then prepared by the same firm in a grease which makes the application of the Graphite to the wire rope easy. Have a tinsmith make a tin tube, trumpet shaped, the small end just large enough to fit the circle of the rope, the other end large enough to carry two or three pounds of the Graphite grease. The rope travelling through this tube will coat it nicely—one coating in two weeks is enough, and this practice alone will double the length of life of the rope. The graphite prevents the wire from rusting—it saves the rope from abrasion when striking hard substances; it also prevents the wires forming the rope from abrasion one against the other as the Graphite finds its way into and fills the minutest spaces and is held there by the fatty substances in the mixture. The facts above are furnished from his own experience by one of the leading mining engineers of the country.

ALEX. RANKIN,

20 Toronto Street, Toronto Ont.

Agent for sale of Mines and Mineral Lands.

CORRESPONDENCE SOLICITED.

Agents in England and New York.

E. H. SARGENT & CO.,

IMPORTERS AND DEALERS IN

ASSAYER'S MATERIALS,

Chemicals and Laboratory Supplies.

125 State Street,

CHICAGO.

HARRIS & CAMPBELL

Latest Designs in Drawingroom, Diningroom
and Bedroom

FURNITURE

With improved Steam Machinery our facilities for manufacturing Cabinet Goods are complete. Our upholstery Department is well stocked with latest imported patterns.

Corner **QUEEN & O'CONNOR Sts.**
OTTAWA.

THIS YEAR'S

MYRTLE

CUT AND PLUG

Smoking Tobacco

FINER THAN EVER.

SEE

T & B

In Bronze on Each Plug and Package.

THE DOMINION

SAFETY BOILER CO.

MANUFACTURERS OF

The "Field-Stirling" Patent High
Pressure Boiler,

The Safest and Cheapest Steam-Generator now in Use.

This Boiler is unusually durable, being made of the best steel and wrought iron exclusively. No cast-iron is employed. It is simple in construction, has a rapid, well-defined circulation, and a large cool mud-drum, where all impurities are collected to be blown off. All parts of the Boiler are readily accessible for the closest inspection. It has great excess of strength and is not liable to be strained by unequal expansion. The water space is divided into sections so arranged that NO EXPLOSION IS POSSIBLE.

Some of Our Leading Customers:

The J. A. Converse Mfg. Co. (A. W. Morris & Bro.), Montreal; The Canada Sugar Refining Co., Montreal; The Pillow and Hersey Mfg., Montreal; The Berthier Beet Root Sugar Co., Berthier, Que.; The Imperial Insurance Co., Montreal; The Massey Manufacturing Co., Toronto; The Acadia Coal Co. (Ltd.), Stellarton, N.S.; Canada Paper Co., Windsor Mills, Que.; Royal Electric Co. (Central Station), Montreal; Dodge Wood Split Pulley Co., Toronto, and a repeat order from A. W. Morris & Bro., after five months' experience; Ingersoll Rock Drill Co. of Canada.

We guarantee Dry Steam and Great Economy
of Fuel. Correspondence Solicited.

J. FRASER TORRANCE, M.E.,

P.O. Box 1707, Montreal.

Manager.

If you want

BAGS

FOR PACKING

ASBESTOS, PHOSPHATES, ORES, &c.,

Send to us for Samples and Prices.

Every quality and size in stock.

Specially strong sewing for heavy materials.

Lowest prices compatible with good work.

We now supply most of the Mining Companies, and those who have not bought from us would find it to their advantage to do so.

THE CANADA JUTE COMPANY (LTD.)

17, 19 & 21 ST. MARTIN STREET,

Established 1882.

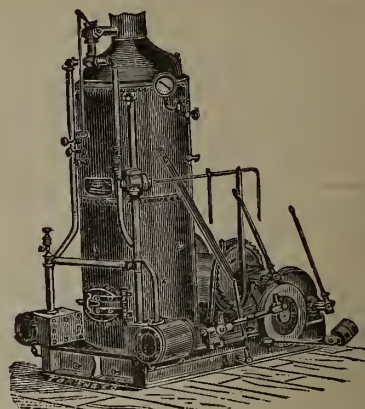
MONTREAL.

M. BEATTY & SONS,

WELLAND, ONT.

HOISTING
ENGINES

ENGINES
FOR
Mines
AND
Inclines



Horse-Power Hoisters,

Stone Derrick Irons,

Centrifugal Pumps.



DREDGES,

DERRICKS,

STEAM SHOVELS,

And other Contractors' Plant.

AMALGAMATING MACHINERY.

Stamp Mills for Wet or Dry Crushing. Huntington Centrifugal Quartz Mill. Drying Cylinders. Amalgamating Pans, Settlers, Agitators and Concentrators. Retorts, Bullion and Ingot Moulds, Conveyors, Elevators, Bruckners and Howell's Improved White's Roasting Furnaces, Etc.

CONCENTRATING MACHINERY.

Blake, Dodge and Comet Crushers, Cornish Crushing and Finishing Rolls, Hartz Plunger and Collom Jigs. Frue Vanner & Embrey Concentrators, Evans', Calumet, Collom's and Rittenger's Slime Tables. Trommels, Wire Cloth and Punched Plates. Ore Sample Grinders and Heberle Mills.

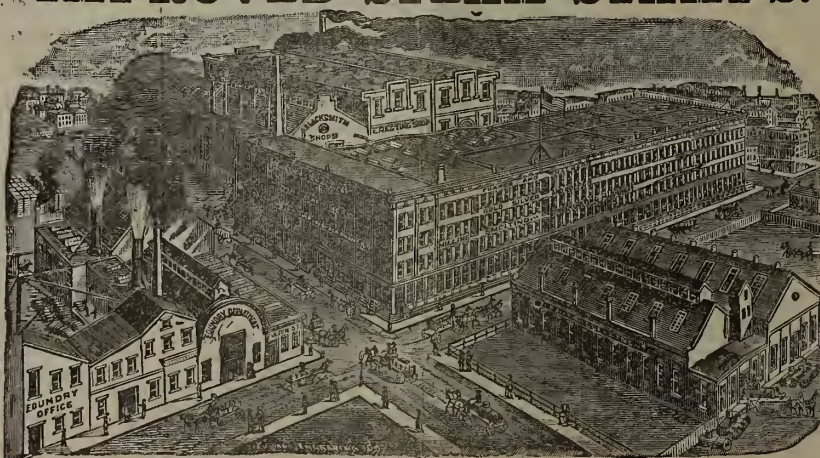
FRASER & CHALMERS, MINING * MACHINERY.

Improved Corliss and Slide-Valve Steam Engines,

Boilers--Horizontal, Vertical and Sectional,

IMPROVED STEAM STAMPS.

Holisting Engines, Safety Cages,
Safety Hooks,
Ore Cars, Water and Ore Buckets,
Air Compressors, Rock Drills, Etc.
General Mill and Mining
Supplies, Etc.



Pumping Engines and Cornish
Pumping Machinery,
Improved Water Jacket
Elast Furnaces for Calena and
Copper Ores.
Slag Cars and Pots,
Roots & Baker Pressure Blowers,
Suspended Tramways.

Sectional Machinery for Mule-Back Transportation.

General Offices and Works: FULTON & UNION STS., CHICAGO, ILL.

BRANCH OFFICES: NEW YORK, Room 43, No. 2 Wall St. DENVER, COLO., 1316 Eighteenth St. SALT LAKE CITY, UTAH, 7 West Second South St. LONDON ENGLAND, 23 Bucklersbury, E. C. CHIHUAHUA CITY, MEXICO, No. 11 Calle de Juarez. LIMA, PERU, South America. JOHANNESBURG, TRANSVAAL, South Africa.

The Canadian Mining Review

CONDUCTED BY . . . B. T. A. BELL

OFFICES:

UNION CHAMBERS, 14 Metcalfe St.

OTTAWA.

Vol. VIII. JUNE, 1889. No. 6.

Notice to Correspondents.

Being desirous of publishing our next issue on the 15th inst., our Correspondents will greatly oblige by furnishing their usual Contributions *not later* than the 12th July.

Scientific Agriculture.

The publishers beg to announce that the Review's Annual Exhibition Supplement will be entirely devoted this year, to the subject of scientific agriculture, particular emphasis being laid upon the value and importance of Canadian phosphates and phosphatic manures as a means of enriching the soil. Arrangements have been made for a series of articles of special interest to the Canadian farmer, among them the following:

Agricultural Fertilizers—By Dr. FRANCIS WYATT, New York.

The Soil—By ANDREW H. WARD, Agricultural Editor of the *Boston Herald*.

The Application of Finely-Ground Phosphate of Lime—By Prof. A. F. GUERARD.

The Occurrence of Phosphates in Nature—By Dr. G. M. DAWSON, Assistant Director Geological Survey of Canada.

Nitrates v. Phosphates—By W. H. IRWIN, London, Eng.

The Importance of Phosphates and Phosphatic Manures to the Canadian Farmer—Excerpted from the various Official Reports of the Hon. JOHN CARLING, Minister of Agriculture.

It has been decided to furnish every farmer in the provinces of Ontario and Quebec with a copy of this issue.

Readers of the Review desirous of obtaining extra copies for distribution among their friends will please send in their orders now, in order that due provision may be made before going to print.

Advertisers desirous of reaching the mining and agriculture classes will find this issue a valuable medium, admirably adapted to their purpose; contracts are being made now, and the spaces are rapidly filling up.

Mineral Wealth of British Columbia.

The Report of Dr. George M. Dawson, F.G.S., Assistant Director of the Geological Survey of Canada, on the mineral wealth of British Columbia, is so complete in its general bearings, viz., history, geography and geology of that country, that all who may have the privilege of reading it cannot fail to be interested and instructed; and particularly those who are now, or have been engaged in mining pursuits; and to such, the fact that so much mineral has been, and is being wrought, must be astounding.

There can be no manner of doubt as to the future of this new country ranking with the foremost countries of the world in a commercial point of view, and at a very early date; particularly so, as the facilities for transportation by land and sea are now complete, and thereby linked with the whole world.

In a concise form, reference will be made to the enormous wealth in gold, coal, and other minerals that have already been taken out in past years, when transportation in that country was confined to the old principles of portaging and land carriage, to say nothing of the crude mining appliances used by miners in those early days.

Comparing this imperfect and defective machinery with that of to-day, which science and practice have perfected, and which enables the miner and mill man to overcome difficulties that in those early days would have been insurmountable.

These improvements, coupled with the rapid developments of this country, should induce us to accept this field as one demanding our immediate attention, time and money.

The Report is the result of very careful investigation and compilation, and shows an utter absence of the desire to "boom." It savors of modesty and truthfulness throughout, and is written, as it states, with a twofold object, viz: Firstly, "As an exponent of the mineral wealth, and to provide an answer of a general kind to enquiries so frequently made; and secondly, "designed to place in the hands of the prospector or miner a constant synopsis of facts."

The Province of British Columbia has an area of 390,344 square miles, includes a length of 800 miles of the Corderilla mountain belt, a region of mountains very much disturbed geologically, and which has, between the Pacific Ocean and the elevated margin of the great plains, a breadth averaging about 400 miles. The mountain range extends north east and south-west, and represents the northern continuation of the most important metalliferous area of the United States.

The "Corderilla belt" in British Columbia has four great mountain systems, which run nearly parallel to each other and the coast, and known as "The Rockies," "The Gold," "The Coast," and "The Vancouver" ranges.

1st. The Rocky Mountain range is the furthest inland, and has an average breadth in the southern part of about 60 miles, but this is decreased near the Peace River to 40 miles or less.

Near the 49th parallel several summits occur in this range which exceed 10,000 feet in height, but above the sources of the North Saskatchewan and Athabaska the range appears to culminate, the mountains "Prown" and "Murchison" occur with separate heights of 16,000 feet and 13,500 feet respectively.

More or less snow fields occur in many places, and true glaciers are found at the heads of the

Bow, North Saskatchewan and Athabaska rivers.

The mountains are well timbered wherever sufficient soil exists for the support of the trees, and owing to the greater rain fall on the western slopes of the range, the forests are there very dense.

The geological formation of this range is somewhat varied. Crystalline slates and granites are scarcely known in any part of this range between the 49th and 60th parallels. The rocks belonging to the Cambrian and carboniferous formations being about 28,000 feet in thickness are found in the Bow River region carrying deposits of copper and galena. There is also found basins of rocks of the Cretaceous age, and in these beds anthracite and bituminous coals are found.

On the south-west side of this range is a straight wide valley, traceable for 700 miles from the 49th parallel to the head waters of the Peace River. It is watered by the sources of the Kootanie, Columbia, Fraser, Parsnip and Finlay rivers.

Placer gold has been found and worked at a number of points along this valley, and important discoveries of various ores are now being made near Upper Columbia and the Upper Kootanie rivers.

2nd. The next mountain system is to the south-west of the "Rocky" Mountain, and referred to as the "Gold" range. The Purcell, Selkirk and Columbian ranges constitute its southern part, while to the north lie the Cariboo, Omineca and Cassiar mountains. The highest mountain is Mount Donald, measuring 10,645 feet in height, and lies on the line of the Canadian Pacific Railway. Granites and slates of old ages, together with great masses of palæozoic rocks, prevail in this range, and it may be regarded as the most important metalliferous belt of the province. Discoveries have already been made of gold and silver ores; also of argentiferous galena.

Between this range and the coast range lies the interior plateau of British Columbia, having an average width of 100 miles, and lies at an elevation of 3,500 feet. It is traversed in various directions by a system of trough-like valleys of erosion, generally occupied by streams and rivers.

The tertiary rocks of this plateau hold in many places beds of lignite. These plateaus also present some important granitic areas. As a metalliferous region it is destined to take high rank. Placer gold deposits have been worked, and platinum is abundant in the Similkameen region.

The Cascade range of Oregon and Washington is largely composed of eruptive volcanic material, to which its characteristic features are due (viz., Cascade), though these materials rest upon a basis of older rocks.

Near the mouth of the Fraser River its place is taken by a new mountain system geographic-

ally and geologically distinct, in the composition of which volcanic ejectamenta play no prominent part.

3rd. The "Coast" range has an average width of 100 miles, and consists of numerous constituent ridges. The altitudes of the higher summits are from 6,000 to 7,000 feet. Glaciers are of frequent occurrence and of large size. The mountains are rugged and well timbered. Geologically this range owes the greater part of its elevation to a period later than the Cretaceous, of which formation patches are found in them at great heights. The rocks consist of grey granites and gneises and other crystalline schists, as well as palaeozoic. In the latter rocks gold placers occur locally, whilst copper and iron ores are frequently found, and rich silver ores have been discovered.

4th. The "Vancouver" range is to a considerable extent formed of crystalline rocks like those of the coast ranges, principally composed of the Palaeozoic and Triassic age, and is flanked in places (both in Vancouver and on Queen Charlotte Islands) by Cretaceous rocks, which are important because of their coal bearing character. The areas underlaid by these rocks are generally comparatively low and hilly rather than mountainous, while a large tract of level land based upon the Tertiary formation occurs in the north-east part of Queen Charlotte Island. Gold placers have been worked in several places in Vancouver, but few ever attained much importance. Iron, copper, lead ores and gold bearing quartz have been discovered, but up to the present time the coal deposits have proved to be vastly its most important feature.

British Columbia first rose from the position of a fur country to the rank of a colony on the discovery of gold upon the Lower Fraser in 1858. Its subsequent history for a number of years is substantially that of the sudden rise and subsequent slow decline in importance of placer gold mining. Coal mining has, however, concurrently advanced slowly but steadily till it has attained its present pre-eminent position. With respect to vein mining proper we have as yet to chronicle merely the first steps; but in the southern part of the province the completion of the Canadian Pacific Railway has at length forwarded the necessary impetus in this direction. Everything which has been ascertained of the geological character of the province as a whole tends to the belief that so soon as similar means of travel and transport shall be extended to what are still the more inaccessible districts, these also will be discovered to be equally rich in minerals, particularly in the precious metals gold and silver. In the southern district, for which information is most complete, praiseworthy efforts are now in progress at a number of widely separated localities, toward the exploitation of ores, which in many cases have already been proved to be of an exceptionally valuable character. Hence it is, that every reason is entertained for witnessing the inauguration of an

era of mining activity of the most important kind.

While it is affirmed that gold is very generally distributed over the entire area of the Province of British Columbia, so much so that scarcely a stream of any importance in which at least colour of gold may not be found, the principal discoveries of important mining districts have been found along the systems of mountains and high plateaux which comprise the Purcell, Selkirk, Columbia and Cariboo ranges and their north-western continuations lying to the south-west of the Rocky Mountain range. Of all the gold producing districts, that of Cariboo has proved the richest and steadiest producer. The estimate of the yield of gold from the year 1858-1888 being \$54,108,804. The whole of this amount, with the exception of a small quantity of bullion (obtained from a quartz mine) is entirely due to placer mining.

The condition of workable auriferous lodes yet remain to be studied in detail and discovered as the development of mining of this kind progresses.

With regard to the silver ores of British Columbia, there is every reason to believe that before many years elapse the province will take its place as one of the great silver producing regions of the world.

Argentiferous galenas appear to be the most abundant ores, and the knowledge of these already obtained is sufficient to enable the silver belt to be traced from point to point from the international boundary north-westward to the 60th parallel of latitude (forming the northern boundary of the province) and beyond it to Forty Mile Creek, where the Yukon leaves the North-West Territory to enter Alaska. The belt thus defined is about 1200 miles long, and wherever it has been explored and prospected highly argentiferous galena ores have been found. Most of the discoveries so far made are those in the southern part of the belt, within easy distance of the Canadian Pacific Railway, and from analyses made these ores are in some cases exceedingly rich, running from 100 to 1700 ounces of silver to the ton, besides carrying gold, copper and lead in good percentages. In these same districts cinnabar and copper ores have been found.

To those of our readers unacquainted with this country it will be surprising to learn that there are four large collieries in full operation, employing 2000 men. The output for these collieries since 1853-1888 is about $4\frac{1}{2}$ million tons, the markets being California, San Diego, Oregon, Alaska, Hawaiian Islands, China, Japan, besides Her Majesty's naval and other mail and trading steamers.

The analyses given of these coals are very surprising, being equal and in many cases superior to the North of England and Welsh coals. It is claimed that the evaporation power is 13.41 lbs. water per lb. of fuel. In practical work 9 lbs. is about the highest service attained, but 13.41 lbs. can be got by experiment,

The anthracite coals analyse very well, but do not (as claimed) compare with the Pennsylvania anthracites, but are, at the same time, a good marketable coal.

Carbonate iron ores are found in this coal formation. These, with the mixtures of the magnetites and hematites should produce a good pig-iron and start the manufacture of finished iron and steels.

The building stones found at the different places, such as the pink and grey granites, sandstones in variety, together with marbles of all hues, are pronounced of good quality and well suited for construction purposes.

In conclusion, it is to be hoped that wise and proper means will be adopted to preserve the high standard of merit that this new field possesses, in order that confidence when established may be maintained, and that the prospector, the miner and capitalist may work harmoniously together, having for their motto "Unity is strength."

LETTERS TO THE EDITOR.

Coke, or Charcoal?

The Editor

THE CANADIAN MINING REVIEW:

SIR,—The text of a bulletin, in which the progress of smelting at the Sudbury Copper Mines has been connected with the announcement of a proposed coke iron furnace at Trenton, Ont., and all to show the necessity for the free importation of coke, has been going the rounds of the press. It is most desirable to afford every facility for the reduction of ores, and if the importation of coke is essential to attaining economic results for the enterprises springing into life in the Lake Superior District, few would attempt to gainsay the calculations of experts who have doubtless considered the fuel question which heads this paper, "Coke, or Charcoal?" It is not therefore intended to offer any objection to the proposal to import coke, if such is intended. But it happens that the mineral interests of the Dominion affect a wider constituency than the United States, and to all our trans-atlantic friends who buy copper stocks or who may contemplate investment in Canadian mines the proposal to import a foreign manufactured fuel, rendered costly by long inland transportation before it reaches lake navigation, will at once give rise to the question, are there no forests in Canada? Whatever the opinion entertained by American experts on the merits of coke fuel, it is a matter of duty to communicate the information that within sight of Sudbury, and within a very few miles from any iron or copper mine in the Province of Ontario, are immense forests of the best hardwood fuel, and that charcoal kilns can be erected and the fuel manufactured of the best quality at a varying cost of \$6 to \$7.50 per ton of 2000 lbs. for hardwood coal, and \$2.90 to \$4.50 for softwood coal.

The historic fuel for copper is charcoal. Overman says that certain Norway and Sweden brands of copper are remarkable for their purity, testifying to the careful metallurgy attained by the people of these countries with

charcoal fuel in the manufacture of copper as in iron. The copper reduction processes of Germany as described by Ure are made with charcoal. The highest quality the smelter can turn out is demanded by the electrician, and it would seem that his requirements may be best attained by the use of charcoal. "The higher temperature at which reduction proceeds carries more impurities into the metal," is the theory of Belani for the relative inferiority of coke to charcoal. And this higher temperature is due to the greater pressure of blast necessary for the combustion of coke, and is attended with a greater consumption of fuel. The surface presented by charcoal in the fissures and intercellular spaces in its structure is $5\frac{1}{2}$ times that of coke, and the rapidity of its ignition is as $1\frac{1}{2}$ to 1. A test conducted at Kingston, though not conclusive, supports the view that good hardwood charcoal in a horizontal fire will decompose jets of superheated steam effectively, and work quite as well as anthracite in the manufacture of water-gas. An attempt to generate the gas from steam passed through coke was a failure.

It is difficult to see why copper should be smelted with coke at Sudbury, Ontario, in the presence of abundant supplies of wood, when the silver smelting furnaces of Colorado are reported to be using "seven and a half millions of bushels of charcoal annually, which is made in meilers and kilns from Pinon pine, balsam and spruce wood, much of it dead timber from burned tracts." If the reason is that there are no charcoal-burners there will be no difficulty in importing them from Sweden. The Government of that country maintains a "School for Charcoal-Burners," in which the theory and management of meilers is taught, and so successfully that it is claimed that Swedish charcoal made "under dust" is superior to that obtained from American kilns, and the product equal in quantity.

Prof. Kerpely, a Hungarian expert of continental repute, in a report on the iron industry of his country in 1884, gives some information on a state of affairs there to a great extent on all fours with the fuel question in this country. He says: "The demand for raw material (for forges and mills) can only be met by increased imports or by building new blast furnaces. The Government is putting up two furnaces at Vajda-Hunyad. Until now 45 charcoal furnaces were running; in the future there will be 48. I cannot pass over the fact that some leading men who assume to be experts in iron-making, and unfortunately are acknowledged by many as such, have insisted recently that works using charcoal as fuel are doomed. According to these gentlemen, the majority of our blast furnaces, and those of our mills and forges using charcoal, should be demolished, and our iron industry be simply turned over to our competitors of neighboring countries. But these gentlemen know only too well that there are in Hungary more than 5,700,000 acres of forest, the greater part of which is only of use to iron manufacture. Even its use for building timber is profitable only when accompanied by using the waste for the manufacture of charcoal; foresters insist upon clearing the ground of this waste, and therefore both combined not only lead to a low cost for the charcoal, but even yield a small profit. It is certain that one half of the timber in our forests is beech, which can only be used as cordwood. The fact that the greater part of these forests is remote from the iron manufacturing districts is not nowadays an obstacle to the transportation of the charcoal, because a large part of the forests is within reach of our railroads, and because the adminis-

tration of the latter, in their own interests and in that of our iron industry, have put the rates so low that a number of works can now draw a large supply of charcoal from remote districts. Thus, forest areas which have been unproductive for decades can be worked to a profit, and a living is assured to thousands, besides increasing the taxable value of property. The importance of this movement from an economical point of view needs no further discussion. The manufacture of charcoal pig-iron does not therefore deserve adverse criticism, but should have the support of the trade and of patriotic men, particularly because the iron thus produced is far superior in quality to that smelted with coke or coal, and secures to us foreign markets. Even if decades from now, we were the only producers of charcoal pig-iron, after the latter has become scarcer and scarcer, and the demand has grown for certain purposes, that would not alone be a disadvantage, but would be a positive advantage, and with this prospect before us we should not diminish our production of charcoal pig-iron or ever abandon it."

In the place of Hungarian beech we have the Canadian maple, covering millions of acres of no value except for the manufacture of iron, or other smelting purposes. Made into charcoal, the process of coaling offers to the owners for every acre chopped and hauled to the meilers or kilns from \$30 to \$60, according to the amount of wood obtained. The importation of coke for copper or iron smelting offers to Ohio colliers and coke-burners and to American railroad and vessel owners a yearly increasing tribute from the industry of this country. And yet the profits which these proposed coke furnaces would forego may be found printed in every trade journal. "The Plymouth, Mass., rivet manufacturers use largely Swedish iron, which comes in the form of iron rods. They pay a duty of \$12 a ton of 2000 lbs. for 5 gauge upward, and below No. 5 a duty of 45 per cent. *ad valorem*. The rods cost from \$65 to \$70 per ton of 2240 lbs. The Swedish or Norway iron wire costs about twice as much as American wire." Here are the latest prices of No. 1 charcoal and coke iron per ton in the United States:—

CHICAGO.

Lake Superior Charcoal	\$18 50
Tennessee do	19 00
No. 1 Coke	16 00
Southern No. 1 Coke	15 75

CINCINNATI.

Hanging Rock Charcoal	\$21 00
Tennessee and Alabama Charcoal	18 00
Hanging Rock cold blast "	25 00
Southern Coke	14 50
Ohio Soft Coal	16 00

CLEVELAND.

No. 1 Lake Superior Charcoal ...	\$20 50
No. 1 Am. Scotch	18 00

LOUISVILLE.

Southern Car Wheel	\$22 75
Hanging Rock No. 1 Charcoal	21 00
No. 1 Southern Coke	14 75

Much might be said for processes which largely reduce the cost of charcoal fuel, such as Dr. Pierce's system of wood distillation, which is successfully operated in the United States. But as this would involve the presentation of technical details at some length, the subject is reserved for a future issue. The question, shall our metallurgical industries be operated with foreign coke or home-made char-

coal is one worthy of attention on every hand. It is simply the question whether our forests shall be of any value in the development of those industrial enterprises which it is the hope of the people may shortly arise to take away our reproach that we are a country of producers of raw material, and with the best iron ore and the best fuel in the world, know not how to make iron.

J. BAWDEN.

KINGSTON, 15th June, 1889.

A Visit to Port Arthur and the Silver Mountain Mining District.

To the Editor:

THE CANADIAN MINING REVIEW:

SIR,—Your correspondent having taken a trip with some friends to the Silver Mines, south west of Port Arthur, I have much pleasure in giving your readers a short account of our trip.

We left Toronto at 11 o'clock, p.m., per the C. P. R., on Thursday, the 25th April, arriving at Port Arthur, a distance of 857 miles, on Saturday, the 27th, enjoying a very pleasant journey. The scenery on the north shore of Lake Superior is very grand. Resting a few days at the Northern Hotel, one of the finest summer resorts in Canada, we started for the mines by train to Murillo Station on the C. P. R., thence by stage some twenty-eight miles to Silver Mountain, remaining over night at the Half-way House. In the district the following named mines are being worked:—The Beaver, Badger, Palisades, Queen, Silver Wolverine, Silver Fox, Elgin, Porcupine, Silver Creek, Big Bear, Silver Victoria and others, some of them turning out ore to the value of \$1,000.00 and upwards to the ton of 2,000 lbs.

The West End mine of Silver Mountain which has been actively developed, during the past year is rapidly becoming one of the largest and most valuable silver mines in the country. The mine is being opened in four places by shafts, drifts and cross cuts. The main shaft No. 1, now down about 200 feet, has been in continuous ore from the surface, and the levels which are run both east and west on the vein from this shaft, at a depth of 100 feet are all in ore, a part of which is very high grade. In shaft No. 2 a large body of high grade ore was struck a few feet from the surface, and at a depth of 60 feet drifts are being run east and west on the vein, the extent of this ore body is not yet known, it had been opened 70 feet in length, at date of our visit, and as work progressed was getting larger and richer, the bottom top and sides of the levels showed masses of native and sulphide silver assaying from 3,000 oz. to 20,000 oz. per ton. The other workings are not so extensive as the two last mentioned, but show a large strong fissure vein and considerable good ore which is continuous and will doubtless improve with depth. The mine is supplied with steam hoisting and pumping machinery, and the buildings, some twenty or more, are substantial and convenient.

The property consists of 240 acres of land $\frac{1}{4}$ of a mile on the vein, and is admirably situated for working purposes, has good water, and an abundance of timber for fuel and mining purposes. The Port Arthur, Duluth and Western R. R. which is to be built this season will pass this property. At this mine samples of ore are being produced equal to anything that ever came out of Silver Islet, pink ore, and in fact the same class of ore in every particular. The West End from its formation is destined to be a great

mine. The east end of Silver Mountain (Shuniah Weachu) is also turning out a large body of very rich ore; Crown Point, just north of Silver Mountain is also showing good results, rich ore being shipped to the United States from this mine.

Adjacent to Silver Mountain and Crown Point Mines is one of the most promising locations in the whole district known as R. 64 and has eight lodes crossing it, one being a continuation of the Silver Mountain lode and another that of Crown Point. This location is about to be opened up and, it is believed, will be found one of the richest mines in the district.

West of Silver Mountain is being found rich ore and some considerable work has been done. After a very enjoyable visit and being hospitably entertained by Captain H. K. Nichols and Mr. Woodruff, we started on our return for Port Arthur, and sailed from there by the Athabaska, one of the Canadian Pacific Railway Company's splendid steel steamships which traverse with safety and rapidity these magnificent inland seas of Canada. Arriving at Sau't Ste. Marie about 11 o'clock at night, I and the other passengers were attracted by the brilliancy of the electric light on the Canadian side. The town is lighted with the Heisler system of incandescent lights and these at a distance of over a mile from where the vessels lay were most brilliant, the buildings being quite easily discernible. Upon enquiry we found that 100 lights cost the town \$4.00 per night. This town is growing very rapidly owing to the fact that a new canal is being built on the Canadian side, as well as the C. P. Ry. having a branch road terminating there. We arrived in due time at Owen Sound, thence taking the train for Toronto.

Much surprise is expressed at the want of enterprise of the Canadian people, who allow the English and American capitalists to come in and capture the untold millions which lie slumbering in the silver mountains of the Thunder Bay mining district. Thoroughly enjoying the trip it is our intention to again visit the district, and we would recommend all our Canadian friends who can possibly do so, not to let the present summer pass without a visit to the mines, if only for the health giving properties of such a trip, and to see for themselves the magnificent mines of silver, and the wealth that they will yield in the near future. Some of the finest (well timbered) farm lands in Canada are to be found in the valley of the White Fish River. This beautiful valley is about forty miles long and about seven to ten miles in width, a few miles west of Porth Arthur.

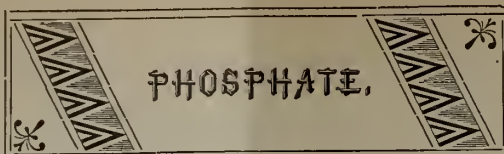
Yours truly,

GEO. A. SHAW,

Lt.-Col. H. M. M's. Vice-Consul.

Toronto, 29th May, 1889.

Soapstone and its Uses.—A writer in a London journal calls attention to the unappreciated uses and preservative qualities of Soapstone, a material, he says, which possesses what may be regarded as extraordinary qualities in withstanding atmospheric influences those especially which have so much to do with the corrosion of iron and steel, and from experiments made it is said that no other material is capable of taking hold of the fibre of iron and steel so readily and firmly as this. In China, Soapstone is largely used for preserving structures built of sand-stone and other stones liable to crumble from the effect of the atmosphere.



Shipments.

The following have been the Shipments of Canadian Phosphate to British and European ports since our last issue:—

Date.	Vessel.	Destination.	Shipper.	Tons.
May 15.	S.S. Colina.....	Glasgow.....	Wilson & Green.	22
" 20.	" Oxenholme....	Liverpool....	" "	305
" 20.	" Fremona.....	London.....	Millar & Co....	375
" 22.	" Alcides.....	Glasgow.....	Lomer, Rohr & Co	400
" 22.	" Montreal.....	Liverpool....	" "	3 10
" 23.	" Castellano....	" "	" "	6 40
" 27.	" Henri IV.....	Havre.....	" "	150
" "	" Lake Ontario..	Liverpool....	" "	300
June 1.	" Kurweider....	Hamburg....	Wilson & Green.	251
" 1.	" Canopus.....	Liverpool....	" "	300
" 1.	" "	" "	" "	100
" 5.	" Michigan.....	London.....	Lomer, Rohr & Co	180
" 5.	" Circe.....	Glasgow.....	" "	400
" 5.	" Lake Superior	Liverpool....	" "	180
" 5.	" Oregon.....	" "	" "	100
" 5.	" Saturnia.....	" "	" "	150
" 5.	" Zambesi.....	" "	" "	100
Total				4303

RECAPITULATION.

Lomer, Rohr & Co.....	2990
Millar & Co.....	375
Wilson & Green.....	938
Total	4303 Tons.

Liverpool	2525
Glasgow.....	822
London.....	555
Havre.....	150
Hamburg.....	251
Total	4303 Tons.

Ocean Freights.

Liverpool freights have been very plentiful, varying from 5 shillings to 7/6, and on one or two occasions even less. On the other hand London freights are extremely scarce, and shippers have to pay the regular liners from 10 shillings to 11/3 and even at these figures no vessels are obtainable, hence the bulk of phosphate is being shipped to Liverpool. There is an accumulation of over 4,000 tons of phosphate rock here in the harbour of Montreal waiting for tonnage.

British Fertilizer Market.

Messrs. Couper, Millar & Company, London, send us the following report:

"The position remains much the same as stated in our last circular, though since the Easter holidays business has been quieter. Nitrate of Soda is very depressed owing to heavy imports, while Phosphates, more particularly those of high test, continue in request even at the advanced prices demanded by sellers.

Mineral Phosphates—Canadian will come forward in larger volume than ever before, and the higher tests are finding a ready market, 80 per cent. we quote at 1/0 1/2, 75 per cent. 11d., and 70 per cent. 10d. per unit, all with one-fifth of 1d. rise. South Carolina enquired for at 9 1/2d. for U. K., and at a proportionate advance for continent. The higher tests of Somme are very scarce but business is being done in the lower grades. Belgian 40 to 45 per cent., and 45 to 50 per cent. is available, but the higher qualities seem to be all bought up. Cambridge Coprolites selling in small lots at 45/6 f.o.r. Bedfords sold forward.

Bone Ash, Bones and Meal—No sales reported at all, and no demand for bones, though Ash is enquired for and will probably be dearer in harmony with mineral phosphates. Indian bone meal dull at £4 17s. 6d. to £5.

Nitrate of Soda down to £8 5s. per ton and very dull.

Sulphate of Ammonia keeps its position well, to-day's quotation being \$11 17s. 6d. to £12.

Ammonical materials are not effected by nitrate as much as might be expected, the supply of nitrogen from organic matter being so limited.

Dried blood from R. plate sold at Liverpool at 10s. 6d. Fish guano and ground hoofs and horns we are sellers of for prompt and forward.

Muriate of Potash is quoted at £7 4s. 6d. 80 per cent.; Kainit at 23s. 6d. in bulk, 26s. 6d. in bags, and Kieserit at 17s. 3., all f.o.b. Hamburg, subject to open river navigation. Net Cash. Strassfurt weight and sampling.

We have received from Messrs. H. & E. Albert, London, a 4 lb. sample of the Thomas Gilchrist Slag, now largely in use among English agriculturists. A large proportion of the phosphoric acid in this fertilizer is soluble in Citrate of Ammonia, which is considered as valuable as the phosphoric acid soluble in water, in the ordinary superphosphates of lime. The senders inform us that Prof. Johnson of the Connecticut Agricultural Experimental station found in a sample:—19.57% soluble in Ammonium Citrate; 0.30% insoluble. This Fertilizer is sold at 30/6 to 35/ per ton in bags f.o.b., Antwerp or Rotterdam according to quantity, or 35/ per ton Newcastle-on-Tyne according to quantity. An extended reference to this Slag was made in our article "Iron & Phosphates," published in Vol. V., No. 4, June, 1887.

Du Lievre District.

The late showery weather has been much felt in the opencast workings of the phosphate mines on the river, but the shipping of the ore has been regular and satisfactory.

A loaded scow of the High Rock Company was lately sunk off the village landing at Buckingham in deep water; a contract for raising it at \$450 was taken, and a clam dredge has been successfully employed for removing the ore; diving apparatus will now be necessary.

Proprietors of phosphate lots have continued to be in a state of expectation in consequence of the many enquiries for bonds and promises of sale, but few transactions have been terminated. A cash sale of the Angus McMillan Lots at the Little Rapids, Portland, East, was effected on the 19th inst., and this property will, we understand, be put upon the London market immediately. The price paid, we understand, was \$15,000.

The Glasgow Canadian Phosphate Company's property is being negotiated in England by Mr. A. D. Cameron, of Buckingham. The price put upon it by the liquidators is \$25,000.

Mr. George Attwood, the well known English mining expert, was upon the river on the 12th and 13th instants, and visited several phosphate properties in Portland West, accompanied by Mr. Lainson-Wills. We are gratified to see men of Mr. Attwood's experience and ability giving their attention to the development of our local mineral wealth.

Mr. Lainson-Wills retired from the management of the Canadian Phosphate Company on the 18th inst., but continues his residence in Buckingham for the development of an important phosphate enterprise.

In view of the remarks of the *Star* and other English financial papers, further comment upon the failure to float the Emerald, Central Lake and Leve River Phosphate Company is

unnecessary. This is but another striking instance of a fairly good investment being swamped by excessive promotion money, and a strong disposition to overestimate the production and value of the properties for sale.

"It is," concludes the *Star*, "no wish or intention of ours to run amuck at all Canadian phosphate properties. Many of these properties are valuable, and may be purchased at reasonable prices, such as will allow good returns to investors. It is because promoters and others are attempting to foist upon the public worthless properties, or, as in the case of the Emerald, properties which, though good in themselves, are swamped with capital, that we think it necessary, in the interests of the industry itself, to speak the truth about them."

We are informed that it is the intention of the owners to put these properties again on the market, with a Prospectus greatly modified in tone, and with the objectionable features characteristic of its predecessor eliminated.

A small force continues to make satisfactory progress with development work at the Little Rapids mines. A number of eminent experts have recently made a close inspection of the workings, and have returned greatly pleased with the appearance of the pits, and all that has been done of late to improve the plant and property. The Rapids were also visited lately by a number of American capitalists who spent a few days at the mines.

Mr. O. M. Harris, who returned from the mines of the Canadian Phosphate Co. on Saturday, reports that things look very well there. He says: "We have struck a very rich deposit of phosphate in No. 1 pit about 100 yards from the Star-Hill Cobbing House which promises to be very productive after we have got down to a greater depth. Our other pits are all looking fairly well and had it not been for the quantity of rain we have been having all this month our output would have been considerably increased."

Mr. E. W. Ingall, M.E., writes: Mr. James White and party have resumed their Geological and Topographical work in this district. At time of writing the party was heading toward the Templeton region.

Kingston District.

The Foxton mine was opened the first week in May, and with an average of eighteen men has produced 200 tons of 80 per cent. ore. The cost of the same delivered at Kingston not exceeding \$6 per ton. The mine is in a very good condition and has fully carried out the expectations of the owners. The new boiler has just been bricked in, and steam drills and hoists have also been purchased, and we look for a larger output in the near future. The ore is of a fine green quality, fully equal in all respects, to anything produced on the Lievre River.

The Memphremagog Mining Co.—

Mr. Chas. C. Smith and Capt. Warne, president and manager of the Memphremagog Mining company, spent last week in New York, and succeeded in making arrangements for shipping 500 tons of ore to be smelted at Elizabethport, N.J. The ore is being mined at the rate of ten to twenty tons per day, and is composed of copper, sulphur, iron, antimony, zinc, and galena. The surface of the vein exposed is 40 feet deep by 1,000 feet long. From the indications the supply of ore is very large.

MINING NOTES.

We shall be greatly obliged to mine owners and superintendents for such authentic reports of their operations as may concern shareholders and the public.

Nova Scotia.

NOTICE.

At the Annual Meeting of the Gold Miners' Association of Nova Scotia, held at Halifax, on 6th March, a resolution was passed adopting the "Canadian Mining Review" as the official organ of this Association. Our readers may therefore rely upon the accuracy of all information published in these columns bearing on the gold mining industry of the Province.

Miscellaneous.

The North Sydney Coal Company, Limited, was registered on the 28th ult., with a capital of £2,800, in £1 shares, to acquire and work coal mines in Nova Scotia. Messrs. W. M. Simpson and F. Roberts are appointed managers both in Canada and Europe, and will be entitled to debit the company with a commission of 5 per cent. on the gross amount of sales and purchases made by them on the company's behalf.

At an adjourned meeting of the Joggins Coal Mining Association held recently, a letter was read from R. G. Leckie, of the Cumberland Coal and Iron Company, of Springhill, stating that he would withdraw the 5 per cent. commission stipulated in his offer, and would allow it to stand at \$200,000 net. After a general discussion, it was decided to adjourn the meeting until the 5th of June, and get in the meantime an expression of opinion from the stockholders on which the meeting might act. The mines, at present, are under lease to the Phoenix Coal Company, and the members of that corporation, many of whom are also shareholders of the Joggins Association, are adverse to the sale, for they are now making money out of the mines, and expect to do still better in the future, as the railroad facilities for shipping will be improved. Should the mines be sold, the Joggins Association will have to pay the present debt and the Phoenix Company for their improvements.

Sherbrooke District.

Matters at Goldenville are very quiet, the only work doing being that of J. H. M. Donald on the old "Mayflower" belt. A force of five or six men are employed all told, and from 200 to 300 tons a month are crushed. The yield is from three dollars to five dollars per ton. Last month gave 29 oz. from 200 tons.

Cochran's Hill.

The work doing here by the English people who have had control of the property for some months past, is very little, some forty feet of shaft and about as much cross-cutting representing development work. It is to be regretted that a more vigorous policy has not been instituted.

Stormont District.

The Palgrave Co. on Hurricane Island are working steadily, and the president of the Co. reports at least one year's reserves ahead. Last month's work produced one hundred and forty-eight ounces from two hundred and eighty tons. Several men were put at surface prospecting the last month but no pay lode has yet been cut.

Messrs. Frazer and Hamilton who were prospecting on Dunn Cove have quit work there, results being discouraging, and now have put their men away to the eastward of the workings of the old Mulgrave vein.

Central Rawdon.

The Northup Lode in this district continues to yield large monthly returns, the product for May being 350 ozs. The lode is believed to be a fissure, as it runs obliquely to the course of the country rock, having a north and south course with an easterly dip. The shaft is down only 130 feet. The mine is situated in the midst of a fine agricultural country.

Waverley.

The Lake View Mining Co. (which is the new name of the old American Hill property) have nearly completed the work of putting in an Ingersoll-Sergeant straight-line air compressor. It will work four 2½" drills. The work of straightening and retimbering the old shaft on No. 6 lode is about completed, the bottom of the shaft having been reached the first week in June. The shaft now measures about 350 feet in depth. Work on the cross-cuts from the bottom of this shaft will commence this month. These cross-cuts (running north and south) are designed to cut the 120 feet of the Taylor belt, and to prospect the eight or ten other lodes known to traverse the belt.

The cross-cut tunnel into Laidlaw's Hill in East Waverley is still driving, but with only two men. The breast of tunnel is now in over 300 feet, but so far no lodes of value have been cut. The object of the tunnel is to cut the rich "Barrel" lode worked some twenty years ago on the surface, some 200 feet or more below the old workings. This work is being done ostensibly by English capital.

An attempt is being made to open up the old De Wolfe property in West Waverley, now owned by Mr. Palgrave of London, G.B. Some of the old machinery has been patched up and will be used to pump out the Tudor and Union lodes which have been flooded and abandoned for twenty years. The machinery, both of mine and mill, is of heavy English pattern and entirely unsuited to the economical working of any mine, much less a low grade gold deposit. It is to be regretted that any attempt to utilize such machinery should be made.

Quebec.

The Asbestos industry continues to rapidly increase in importance, and at all the mines operations are going ahead briskly. It is thought, from present indications, that the output of this mineral from the various districts will be largely in excess of former years. The demand for the product continues strong, and many manufacturers, being unable to obtain their supply of *First*s, have to be content with *Second* and *Third* qualities.

At the Bell's Company mines the new machinery is working smoothly and gives entire satisfaction to the management. It is confidently anticipated that the year's output will not be far short of 2,000 tons, the greater proportion of which will be No. 1 quality.

The Johnston Company continue to produce large quantities of *First*s, and your correspondent estimates that the profits of this concern will figure close upon \$50,000 on this season's operations.

The excellent property owned and operated by the King Bros. looks as well, if not better, than ever. The ore prepared for the market by this firm is exceptionally well cleaned and cobbled, and being of very fine quality, is eagerly sought after by manufacturers. Openings are being made on two new mines on Lot 28 in the 5th Range of Thetford and on Lots 24 and 25 in the 1st Range of Ireland. These give promise of good returns to the owners.

The Wertheims have 125 men working on 15 pits, producing large quantities, which is being shipped to their factory at Frankfort, Germany. The work is done by contract, the mineral being cleaned, cobbled and bagged at something like \$25 per ton, and as the market value of the stuff averages \$75 per ton, it is easy to calculate the profits yielded by this concern. We understand that Mr. Wertheim is now in negotiation with Dr. Reed, from whom the present productive property was acquired, for the purchase of three other lots, 27, 28 and 29 in Range A, Coleraine. Messrs. Copeland and Bacon, New York, are equipping these mines with a full complement of working machinery. This will be in full running order within the next ten days, and it is estimated will make a saving in the cost of production of something like ten dollars to the ton.

An important discovery is reported to have been made on Lot 31, Range A, Coleraine, about a quarter of a mile from the Johnston mine. This property is owned by Messrs. Lake & Mitchell, Sherbrooke, and R. H. Martin, of the Chalmers-Spence Company, of New York. The veins are of good size and excellent quality, and being located in the immediate vicinity of the Quebec Central Railway, the property offers every facility for economical and profitable working.

A good vein has been opened on the property of R. H. Lambly, near the line of Garthby.

M. C. Lionais has, we are informed, been unsuccessful in his Suit against the Frechette D'Auville Company. This company's mines are being worked profitably. By the way, Mr. Lionais seems to be in no hurry with his Suit against the REVIEW.

At the adjourned meeting of creditors of the Scottish Canadian Asbestos Company, before Mr. Justice Billy, Mr. R. C. Smith, representing the American shareholders, moved to dissolve the meeting and set aside all the proceeds in liquidation, on the ground that the company being incorporated under the Imperial Joint Stock Company's Act, the Canadian winding up act did not apply to it. He also moved for a delay to examine into the affairs of the company in Scotland. Mr. W. White, of Sherbrooke, opposed the application on behalf of the Scotch preference shareholders and pressed for the immediate appointment of a liquidator.

The nature of the judgment given by Mr. Justice Billy in this case at Arthabaskaville was simply the appointment of liquidators (Messrs. Hanson Bros., Montreal). There was a motion made on behalf of Mr. Harry Allan, of New York, one of the ordinary shareholders of the company to quash all the liquidation proceedings on the ground that the winding up act in Canada does not apply to companies incorporated under Imperial charter, and that Dominion legislation intended to extend the operations of the winding-up act to Imperial com-

panies is *ultra vires*. The motion to quash was rejected; but, we understand that Mr. Allan is about to make application for leave to appeal to the Court of Queen's Bench on this single ground.

We understand that Messrs. Lomer Rohr & Co. have shipped from Montreal 80 tons of Feldspar per S.S. Zambesi, to Liverpool. This we presume is another shipment from the Villeneuve mica mines for the manufacture of pottery and china ware.

Six thousand and three shares of the Lake Huron Silver and Copper Mining company, standing in the name of the late Francis Hincks, forfeited for non payment of a call of 5 cents per share, will be sold at the company's office at Montreal on the 15th July.

Ontario.

Canada has not been able to make much of its mineral oil deposits, owing to the presence of sulphur in the oil, which caused a disagreeable smell, and fouled the lamps when burning. A means has now, says the *Financial News*, been discovered of removing the sulphur so that the Dominion will no longer require to import great quantities of oil every year from the States, and may even begin to export on its own account.

We have received some excellent samples of galena from the Caldwell mine near Lanark. An assay by Mr. J. T. Donald, Montreal, gives silver 4 ozs. 1 dwt. 16 drams per ton, 2,000 lbs. Mr. Caldwell has a hoisting engine and a couple of pumps, and everything in shape to sink the shaft, but owing to the recent heavy rains the work has been greatly retarded.

Regarding the remarkable gas well at Kingsville, a gentleman who recently visited it, says that the company, in their boring, struck a sulphur spring at the depth of 400 feet. Continuing about 1,100 feet from the surface they struck gas, and concluded to go deeper. A few feet lower down another pocket was found, and so strong was the pressure that the drill was forced up out of the shaft by it. "When I saw the well they had cased it in with a four-inch iron pipe, which was laid along the earth about fifty feet from the top of the well, and turned up at the end like an ordinary gas-pipe. I was there when it was first lit, and the noise made by the rush of the gas was like a railway express, or the roar of Niagara at a distance. The gas, which has a strong smell of sulphur, shot up for about two feet out of the end of the pipe in a solid mass. Then it became flame that reached to the tops of the trees in the neighbourhood. It was a most wonderful sight. The pressure is estimated at 500 pounds to the inch, or close upon 11,000,000 feet per day. Experts say it is one of the five largest wells ever discovered. The projectors are boring a second well, and a company will be organized at once to take the matter in hand. Since this well was struck, capitalists have visited it with a view to investment. A site has been secured, and a company with \$200,000 capital will build a glass factory, employing 100 hands."

Sudbury District.

Correspondence to the *Toronto Mail* states:—The smelting works of the Canadian Copper Company, which have been working without interruption since last December, are treating about 125 tons of ore daily. A second blast furnace of the Herreshoff patent is now being set up, and will be in running order about the

first of August. The company has just effected an arrangement with the Dominion Government whereby such mining and smelting machinery as is not manufactured in Canada may be admitted free of duty, and three carloads of machinery arrived here yesterday under this arrangement. Other orders, which will be filled in a short time, will enable the company to erect eight furnaces, with a total smelting capacity of 1,000 tons of ore daily.

The duty on coke has hitherto checked the smelting enterprise here, but it is understood that the Government have agreed to place all coke required for smelting purposes on the free list by Order-In-Council. It is also understood that proposals have been made to the Dominion and Ontario Governments for the extension of the Central Ontario railway from Coe Hill to Sudbury, on the condition of a grant of \$3,200 per mile from each Government, and that if a satisfactory understanding is arrived at the work of construction will begin at once. The principal stockholders of the Central Ontario Company are also stockholders in the Canadian Copper Company, and they represent that at the present time they can command any reasonable amount of capital for their enterprises. Messrs. Ritchie and Cornell, while in Toronto, authorized the statement that in connection with the extension of the railway northward they will erect a furnace in Hastings county for the manufacture of coke iron, with a capacity of 250 tons daily. They propose to utilize the new Edison patent for desulphurizing magnetic ores, which is claimed to be at once a cheap and a perfect process.

The annual meeting of the Vermillion Mining Co. was held at Sudbury on the 5th inst., when the following officers were elected: B. E. Charlton, Esq., of Hamilton, Pres.; A. G. Duncan, Esq., of Marksville, vice-president; John Oliver, Esq., of Chicago, sec'y-treas.; Board of Directors: Messrs. V. W. Foster, W. D. Hitchcock, E. H. Reid, H. A. Christie and W. S. Miller, all of Chicago, Ill. A carload of ore was shipped from the mine three weeks ago, which assayed 14 per cent. of copper, 11½ ounces of silver and 2½ ounces of platinum to the ton, which is an excellent showing for that quantity of ore. It was sold to a company with reduction works in Chicago.

The Copper Cliff company at Sudbury have just sold 600 tons of nickel, and two more smelters are to be introduced. The Stoby mine is being opened, and operations are being pushed in the township of Dennison by the Dominion Mining company.

Port Arthur District.

The President of the Board of Trade, Port Arthur, in his last Annual Report makes the following appropriate reference to the present methods of purchasing mining lands in that district:

"Mining appears always in Canada to be considered an illegitimate business. Men may speculate in telegraph stocks, which really neither increase nor decrease in value; they may gamble in bank stocks, which seldom vary in dividends they pay; they may boom real estate to such an extent that a city of 150,000 or 175,000 inhabitants has land enough laid out in 'additions' to hold a million people, and which cannot possibly have any other than a speculative value for a generation; they may take a Chicago wheat corner or pork corner, in which they invariably pay for their experience; they may do

a hundred other things of the same character, but these they consider safe or paying investments or speculations as the case may be. But ask them to buy mining lands at two dollars per acre, and invest the most modest sum, not in mining, but in seeing what their lands contain, and what is their answer? If they have courage enough to buy the land they will neither sell at a reasonable price nor show their faith by working. What is the result? To day every working mine in this district is being opened by either English or American companies, and 75 per cent. of the recent sales of Government lands are made to either American or English investors. Is it much wonder that Americans say that we do not appreciate the richness and value of the great mineral district tributary to our town."

Prospecting and taking up iron lands appears to be the chief object of mining men during the past month, the Red Hematite from Nipigon attracting especial attention.

Badger Mine.—They are still shipping high grade ore from here and the Mill is now operating on the rest. The specimens from this mine presented to the Board of Trade are the richest ever seen in the district.

Silver Mountain.—The East End "Shuniah Weachu" is daily barreling some high grade ore for shipment to England.

The West End mine continues the same encouraging development. All the shafts and tunnels are showing up very fine ore. The management are preparing to build a good wagon road from the mine to Whitfish Lake, about 2½ miles.

There is nothing special to report concerning the other working mines which are swinging along as steadily as ever, awaiting railway facilities for which the bonus by-laws are now before the people with every assurance of being carried by a large majority.

A couple of silver lead properties east of Port Arthur are to be developed by some American capitalists. The Ogema is a specially promising property. A road is now being cut to it and a tunnel some 75 feet in length to strike the vein at a depth of 60 feet down will be driven under the direction of Captain Parsons.

Three of the staff of the Geological survey are now doing the district west of Port Arthur in a thorough manner.

Nickel and asbestos have recently been found near Port Arthur and a most successful explorer is now out searching for tin. He is certain he has met with a substance very similar to the tin ore recently shown him.

Government money and fine weather have rendered the roads to the mines excellent travelling.

Bush fires are raging around Whitefish and Arrow Lakes. Bad for the timber but good for explorers.

British Columbia.

Application for incorporation is made by the following companies: The Willow River Gold Mining Co. (Lt.) capital \$25,000; the Alpha Milling and Mining Co. (Ltd.), capital \$120,060, to acquire and work lands at Anderson Lake;

the Donald Gold Mining Company (Ltd.), capital \$10,000, to work mining lands in Kootenay district; the Salt Spring Island Mining Company (Ltd.), capital \$40,000, to acquire and work mining lands on Salt Spring Island.

Canadian Mines on the English Market.

	Price Per Share.
General Mining, Limited £219,752 fully-paid shares of £8	4¾ 4¾
Low Point, Barrasois and Lingan, \$309,100 fully-paid shares of \$100.....	—
Ditto, \$200,000 vendors fully-paid shares of \$100....	—
North Western Coal and Navigation, Limited, £160,500 6 per cent. debentures; coupons June 30 and Dec. 31; principal 1904.....	—
Ditto £149,500 fully-paid ordinary shares of £10.....	—
Ditto £900 fully-paid deferred shares of £100.....	—
Sydney and Louisburg Coal and Railway, Limited, £50,000 cumulative 10 per cent. first preference shares of £10, £6 paid.....	7 9
Ditto, £14,560 fully-paid non cumulative 6 per cent. second pref. of £10.....	3 5
Ditto, £250,000 fully-paid ordinary shares of £10.....	1 2
Vancouver Coal Mining and Land, Limited, £66,850 fully-paid shares of £10.....	—
Ditto, £118,150 shares of £10, £9 paid.....	6½ 7½
Excelsior Copper, Limited, fully-paid shares of £1.....	—
Ditto, shares of £1, 17s, 6d paid.....	—
Shuniah Weachu, Limited, £99,888 fully-paid shares of £1	—
Silver Wolverine, Ltd., £68,465 fully-paid shares of £1.....	—
Anglo-Canadian Asbestos, Limited, £39,132 fully-paid shares of £2.....	—
Anglo-Canadian Phosphate, Limited, £46,340 fully-paid pref. shares of £10.....	—
Ditto, £15,050 fully-paid deferred shares of £10.....	—
British Columbia Smelting, Ltd., £25,000 preference shares of £1, 10s. pd.....	—
Ditto £40,000 fully paid ordinary shares of £1.....	—
Canadian Asbestos and Antimony Company, Limited, £160,000 fully called shares of £5.....	—
Canadian Phosphate, Ltd., £100,000 fully paid shares of £1.....	¾ 1
Bell's Asbestos, Limited, £100,000 fully paid shares of £5.....	17¾ 17¾
White's Asbestos, Limited, £20,000 fully paid shares of £1.....	—
Ditto shares £1 paid.....	—
Jackson Rae Phosphate Co., Limited, \$25,000 fully paid shares of £1.....	—

General Mining.—Accounts to December 31 submitted in April, but an interim meeting is held in November. Dividend for 1884, 5 per cent; for 1885 and 1886, 3½ each year; and for 1887, £4 13s. 9d. per cent. Reserve fund, £29,850.

Low Point.—The vendors' shares, up to the end of 1888, do not rank for dividend until 7 per cent. per annum dividends have been paid on ordinary. Accounts to Dec. 31. For 1887, 5 per cent. was paid on the ordinary shares other than those held by the General Mining Assoc., that Company foregoing their dividend rights.

North Western Coal.—The deferred shares receive on dividend until 15 per cent. per annum (cumulative) has been paid on the ordinary. Accounts to June 30. Dividend for 1887-8, 5 per cent.

Sydney and Louisburg Coal.—Accounts to Dec. 31 submitted about May. Out of the profits of 1884 one half-year's dividend on the first preference shares was paid. No dividend since. Debit to Dec. 31, 1887, £1,574.

Vancouver Coal.—Accounts to June 30 and December 31 submitted in November and May. In the half-year to June, 1888, there was a net profit of nearly £11,000. Debentures, £57,200. Reconstruction has been decided on.

Excelsior Copper.—Registered September 26, 1888. Authorized capital, £450,000; purchase consideration, £400,000, in cash or shares. Fully-paid shares issued to the vendor; partly paid to the public.

Shuniah Weachu.—Accounts to Nov. 20 submitted in February. No dividend yet.

Silver Wolverine.—Registered October 19, 1888, with a capital of £100,000, of which £80,000 was the first issue. Most of the shares were issued to the vendor.

Anglo-Canadian Asbestos.—The Company was registered in November, 1885. Accounts to October 31 submitted in March. No dividend yet. Debentures, £34,450. Reports are not obtainable, but this information is official.

Anglo-Canadian Phosphate.—The preference shares rank first for 7 per cent., and after a like rate has been paid on the deferred shares, both classes rank equally.

British Columbia Smelting.—The company was registered May 9, 1888. The ordinary shares were issued to the vendor, and they do not rank for dividend until the preference shares have received dividends amounting to 100 per cent.

Canadian Phosphate.—Accounts to November 30 submitted in February. Eleven months to Nov. 30, 1888, resulted in a profit of £2,576, which was carried forward.

White's Asbestos.—Registered April 9th, 1889. the authorised capital is £100,000; first issue, £60,000, of which £20,000, fully paid, was issued to the vendor.

Coal Mining in the North-West.

The Lethbridge Colliery—the property of the North Western Coal and Navigation Company, Limited—producing that coal known throughout Manitoba and the North-West Territories as "Galt coal" has been in operation since 1882; though its development properly speaking, only dates from the autumn of 1885, upon the completion of a narrow gauge railway—owned and operated by the same company—from the C. P. Railway at Dunmore, near Medicine Hat, to Lethbridge, a distance of 109½ miles. This company owes its existence to the exertions of Sir Alexander T. Galt, G.C.M.G., who with other gentlemen in 1881 secured coal leases in Alberta, on both the Bow and Belly Rivers. The year following, these leases were thoroughly examined, and from the reports received it was decided to open a mine on the east bank of Belly River, being the site of the present town of Lethbridge.

Early in 1883 the Northwestern Coal and Navigation Company, limited, with a capital of £50,000 sterling was formed for this purpose, and during that and the following year about 3,000 tons were shipped by way of the Belly and South Saskatchewan Rivers to Medicine Hat, and then tested on the locomotives of the C. P. Railway.

These tests proved the value of this coal as a steam producer, but owing to the very short and uncertain season of river navigation it became necessary to abandon this mode of transfer and build the Narrow Gauge Railway above referred to. To do this, the company increased their capital to £150,000 sterling, and bonded the road to the extent of £160,000 sterling, which was formerly opened by the Marquis of Lansdownie, then Governor-General of Canada, on the 24th September, 1885.

Prior to any of the mining operations above mentioned, coal was extracted on the west bank of Belly river opposite the present Lethbridge Colliery, by the late Nicholas Sheran, who probably was the first coal operator in Northwestern Canada.

Mr. Sheran early in the seventies located at the St. Mary's River, about 6 miles south of Lethbridge.

This point being near the St. Mary's crossing of the Benton-Macleod trail, the freighters on their return trip to Benton used to load their "string teams" with coal and sell it on their arrival in Benton.

In 1879 Mr. Sheran moved down the Belly River and located on the west side of the river, as already stated, where the lower trail crossed leading from Macleod to Benton. Here he occupied himself in conducting a ferry during high water, also in mining coal which he sold at \$5 per ton to the freighters who afterwards retailed it in Benton at \$20.

Returning to the operations of the Northwestern Coal and Navigation Company, the output of their colliery since 1885, has yearly increased, even far beyond the expectations of the promoters of the scheme.

The principal consumer of their coal is and has been the C. P. Railway, and *en passant*, it may be said that the success and advancement of the North-West, is, in a great measure, dependent upon the success of this Corporation, and be it said to their credit, even in the absence of competition, they are without doubt most liberal, far surpassing in the writers opinion any of the transcontinental roads to the south of the 49th° parallel.

Owing to the very large and increasing demand for coal in the smelting and reducing

ASBESTOS.

THEO. HAMEL,
44 Mountain Hill, Quebec,

SOLE ASBESTOS MANUFACTURER in CANADA

Write for prices and catalogue. Use Asbestos and save your money. Applied on boilers and Steam pipes it will prevent them from rusting and will economize 33% on fuel.

works in Montana—the State adjoining Alberta on the south—the N. W. C. & N. Co. have for some time past, been moving in the direction of placing their coal on this market.

In the summer of 1888, several car loads were shipped by way of the C.P.R., St. P.M. & M., N.P.R.R. to various smelters in Montana for the purpose of being tested. The result being favourable, negotiations are now in progress for the construction of a railway from Lethbridge to Helena, Montana.

The completion of this road will probably increase the present output about 500 per cent., in which event Lethbridge will be quite a busy centre of trade, where a few years ago, prior to the construction of the Canadian Pacific Railway nothing but desolation reigned.

The Empress Mill, Renfrew District, N. S.*

By J. E. Hardman, M. E. Oldham.

Probably in no other country where gold mining has been carried on for nearly thirty years has so little advance in methods of milling been made as right here in Nova Scotia.

It is doubtless owing to this fact that so much general interest has been shown in the ten stamp mill recently erected for Mr. C. H. North, at Renfrew.

The mill which I am about to describe in detail, is essentially and in all important points, the mill which has been in use in the Black Hills of Dakota for some years.

Mr. D. S. Turnbull, the superintendant of the Empress Mine, and under whose supervision the mill was built, has had an extensive experience at the Homestake and other Dakota mines.

On the 1st of February, 1889, there were 685 stamps running in the Black Hills. Of this number, 580 were essentially of the one type or pattern, known as the "Homestake," 25 in the "Cassel" mill were of older pattern, and 80 in the "Caledonia" mill were of a distinctly different type. The largest number of stamps in any one mill in the Hills is 120: the largest number owned by any one company is 200, by the Homestake; but as the larger part of the shares in each of the five large companies now operating is held by the same individuals, the same policy prevails throughout nearly all of the mills.

Of the 685 heads, 320 are located at Lead City, 240 at Terraville and 125 at Central City.

These mills were all built in 1878, 1879 and 1880 (with the exception of the last 20 head in the Caledonia, which were added this year), so that this particular type is no experiment, since it has been in use from eight to ten years. During this time minor changes have, of course, been made, but the pattern as a whole has not been changed.

I have drawn your attention to these figures and facts, as perhaps, a necessary introduction to the subject of this paper.

THE BUILDING AND ORE BINS.

The Empress Mill covers a ground space of forty feet square; of this, a portion covering sixteen by forty feet is devoted to ore bins and rock breaker, the remaining twenty-six by forty feet includes the mill proper. The building was designed for twenty stamps, but only ten have yet been erected; I am told the other ten will be added this year.

The posts of that portion devoted to ore bins are forty feet in height; the other portion is built with a shed roof, and the general arrangement of the building can be seen from the accompanying photograph.

There is nothing especially novel in the framing of the building itself, but perhaps one feature

may be of interest to the members, viz.: the battery blocks were built in place before any portion of the building was erected, and the battery sills are the sills of the ore bins; this method ties together the battery frames and ore bins, and by the other parts of the frame of the bins, ties to the building. The method has the great feature of economy, but also has the objection that if the ore bins are not full, the frame of the building is more or less in vibration; with the bins full, the bracing is rigid and the method very satisfactory.

The battery blocks are built of selected white hemlock plank, six inches and twelve inches wide, spiked together, and so placed as to break joints. The planks are of two lengths, ten and fourteen feet, respectively, the fourteen feet plank forming the block proper, and the ten feet plank forming the connection between the longer planks, thus practically making one solid block of plank on end, thirty inches wide by twenty-seven feet long, and ten feet in depth below mud-sills. The accompanying sketch will illustrate the idea.

These blocks are fastened with binders in the usual way, bolted together with transverse rods, the upper binder being on a level with the top of the mortar block, and the lower one three feet below. The mortars are fastened to these blocks in the usual manner, each mortar having eight one and a half inch bolts, five and one-half feet in length.

Parallel to the mortar blocks, and thirty feet in length, are four mud-sills, two on each side, spaced four feet from centre to centre; the top surface being on a level with the ten foot timber in the mortar block. These sills are sixteen inches thick and eighteen inches wide. On right lines of these mud-sills are placed six cross or battery sills, each twelve inches by fourteen inches, spaced five feet seven inches apart, centre to centre. Where these battery-sills cross the mud-sills and the battery-blocks, a cut two inches deep is taken out, thus locking the sills and bringing the cross-sills solidly on the mortar-blocks. Upon these battery-sills are erected the battery-posts, twelve inches by fourteen inches, which carry the cam-shaft and guide timbers. Upon these sills also are mortised the posts, sixteen inches square, of the ore-bins, and the diagonal braces of the bins are also tied to these sills. These posts run up and connect with the frame of the building, and the horizontal beams of the bins are also mortised into these posts. On these beams comes the weight of the ore, also the strain due to the rock-breaker and to the tram car.

It will thus be seen how almost every part of the inside and outside framing is braced to and dependent on the battery sills, which are securely locked to the battery-blocks and mud-sills. The economy alluded to on page 3 is now apparent. No heavy foundation other than the one for the batteries is necessary.

The ore-bins are triangular in section, with the vertical side towards the battery; they reach to the cam floor and end in a chute which conveys to the self feeder. The two sides of the right angle are sixteen feet in length, and the capacity of the bins is about two hundred tons.

To the upright posts of these bins on the vertical side, the battery frames are braced by means of two short horizontal struts, and tie bolts, one above the cams, near the top of the battery post, and the other forming the beam for the cam floor. These struts are mortised into both battery posts and ore-bin posts. This method of bracing leaves the entire front of the battery clear, and gives the maximum amount of light on the plates.

The line-shaft of the mill lies directly on the battery-sills back of the mortars, and beneath the feeding floor. To this arrangement many exceptions may be taken, necessitating as it does, short and nearly vertical belts to the cam-shaft pulleys, and the consequent use of tighteners, to say nothing of the constant drip from floor above, and the attendant darkness, but the purpose of this paper is not to criticise, only to describe.

THE BATTERIES.

The drawings accompanying this paper are of the Homestake mortars, the Empress mortars being precisely like these drawings with one unimportant exception, namely, that the discharge opening has been lowered relatively four inches as shown by the red ink line in fig 3. That is to say, Mr. Turnbull being somewhat influenced by the prevailing notions in the province regarding high discharge batteries, yielded so far to the current prejudice as to put four inches more in the bottom of his mortar, thus decreasing the height of discharge that amount. I am informed by him, that, after two months experience with the same, his next batteries will not be modified, but will be made exact copies of these drawings.

The drawings are self explanatory and need no letter press.

The features of importance are:—

(1). The inside dimensions of lower part of mortar: that is the sides and ends are drawn in towards the die, leaving a space of only one inch on the ends, and two inches on the back from the face of shoe or die. This conduces to rapid crushing by tending to throw the pulp directly under the shoe.

(2). The so-called "Graham" chuck-block which is removable, and can be replaced with one smaller. The first one used is seven inches high, but when the die has worn down two inches, the seven inch chuck-block is removed and replaced by one five inches wide, which lasts for another two inches wear, when the die is usually thrown out and a new one put in. This chuck-block makes a high discharge mortar, and facilitates amalgamation in the battery. With the Homestake having the discharge eight and three-quarter inches above bottom of mortar and adding seven and one-quarter inches of chuck-block makes a mortar sixteen inches deep. In the Empress four inches of this have been removed and the mortar is between eleven and twelve inches deep.

While speaking of this chuck-block I may say that Mr. Turnbull has substituted a piece of six inch channel iron for the wood of Mr. Graham, with excellent results.

As shown in the drawing, there is only one inside copper plate fastened right on the chuck-block, this plate is three-sixteenths of an inch thick.

It is claimed that 55 per cent. of the free gold is caught by this plate. The Empress mill has no plate on the back or feed side.

As will be seen from fig 1, the feed opening does not extend the whole length of mortar, but is only twenty-four inches long.

The Empress mortar weighs 6500 pounds. The stems are of wrought iron three and one-quarter inches diameter, turned full length; they are twelve feet six inches long and weigh 356 pounds each.

The tappets are the two gibbed, double-faced pattern, twelve inches long, nine inches diameter at face, and six inches diameter in the middle; each weighs 132 pounds. The head or boss is nineteen inches long, eight and one-half inches diameter, and weighs 235 pounds. It has no rings shrunk on, but is all cast-iron.

The new shoe is eight and one-half inches diameter, and eight inches high, and weighs 135 pounds.

The total weight of each stamp is therefore 878 pounds; this statement will perhaps surprise some members present who have been told that the stamps weighed 925 pounds, but I desire to say that these figures were given me by actual weighings of the different parts, and may be taken as correct. Moreover, they correspond with the weights given by the Homestake Co., viz.: stem 340 pounds, tappet 140, head 240, shoe 130, total 850 pounds.

The cams are double armed and each arm is 17 inches long from centre of hub. The weight is 236 pounds. The short arm has a beautiful curve, and the stem is raised without the slightest perceptible jar to the tappet.

The cam shaft is fourteen feet long and five inches diameter, it runs in babbitted iron boxes, and weighs 930 pounds.

The Die is eight and one half inches diameter and weighs 93 pounds.

The cams are lubricated with molasses, forming a smooth surface which does not so readily catch grit, and which revolves the stem in about three drops. The order in which the stamps drop is 1, 3, 5, 2, 4.

The guides in the Empress Mill present a new feature which I consider admirable, and worthy of adoption by us all. Instead of the usual two pieces of hardwood scored with five grooves across the grain, each stamp has its own guide block. These blocks are two pieces of hardwood about sixteen inches long, (with the grain), and eleven inches wide and three to four inches thick. The groove is cut in these blocks *with the grain*, each half block being made from a template which serves for the whole mill, and is bored for two seven-eighths inch bolts; which fasten the two halves solidly to the guide timbers. Thus each stamp has its own guide, which can be replaced by merely removing two bolts, without disturbing the guides of the other four stamps in the battery.

The Empress Mill uses twenty mesh twilled wire screens, and this is undoubtedly one reason for an increased capacity. The screens measure forty-eight inches by thirteen inches. But the difference between wire cloth screens and slotted screens is not by itself sufficient to account for the increased capacity of the mill, the other features are fully as important factors.

The outside plates are those taken from the old mill, and at present each battery has one four feet square plate, followed by a plate narrowing down to twenty-four inches at the bottom, and about three feet in length. This arrangement of plates is but temporary, Mr. Turnbull contemplating some marked changes.

The quartz coming from the mine is trammed directly into the top of the mill, and dumped about four feet to the breaker floor. No grizzlies are used. The quartz is fed by hand to an old pattern Blake crusher, which is entirely unfit for the work. It is proposed to substitute a small-size Gates crusher. The ore falls from the rock breaker into the ore bins, and thence runs down a chute to the automatic feeders. These machines are the "F. B. Hammond" patent feeder, and detailed information concerning them is not accessible. They are exceedingly simple in construction and appear to me to be by all odds, the most efficient feeder I have seen. I understand that the Truro Foundry Co. have the sole right to manufacture the same, but of this I am not positive.

THE MOTIVE POWER.

The power to drive this mill is furnished by a brook, which appears to have a flow of about

2,000 cubic feet per minute. The old mill was driven by an 18 foot overshot wheel, but Mr. Turnbull, by cutting a ditch along the hill-side some 300 feet or more long, has increased the head to 34 feet. The water-wheel is a turbine on a horizontal shaft, called the "Perfection," and made by Paxton, Tate & Co., of Port Perry, Ont. It is 27 inches in diameter, and is enclosed in an iron scroll case. The wheel is located back of the mill, on a separate foundation, and has a head direct of 20 feet, with a draught tube 14 feet in length.

The gate was only one-quarter open at the time of my inspection, and the power was ample, but, owing to the fluctuation of speed caused by the old-fashioned breaker, a governor would seem to be necessary. I understand that it is the intention to put a governor on the wheel this summer.

A pulley on the wheel shaft transmits the power directly to the line-shaft of the mill, by means of a six-ply rubber belt.

The water for the batteries is taken from the iron penstock above the wheel by a four-inch pipe, and distributed to the stamps by half-inch pipe nipples leading to each stamp. No arrangements have yet been made for heating either water or building in winter.

At the time of my visit, the 27th of May, the stamps were dropping sixty times per minute, and had seven and one-half inches' drop. Mr. Turnbull informed me that he was crushing one and one-quarter tons per stamp per shift of ten hours, at that speed. It is his intention to run at 80 to 85 drops per minute, when the new Gates crusher is in, and the supply of ore from the mine warrants it.

I have no hesitation in expressing my opinion in regard to the mill and its capacity. It seems to me to be the mill which all Nova Scotia gold miners can study and copy to advantage. It is the best built mill I have seen in the Province, both as respects iron work and wood work. I believe it can easily crush 25 tons of our Nova Scotia quartz in 24 hours. As to its capacity for saving gold, it has yet to be tested. But the runs already made have caused Mr. Turnbull to state that he is getting four dollars per ton *more* than he got out of the same quartz with the old mill.

It is still an incomplete mill in the fact that it has no provision for concentrating and saving the sulphurets in the ore. I am told that Renfrew concentrates assay only twenty dollars per ton, if that is the case, it is perhaps better economy not to attempt to save them. But a new type of the Hooper concentrator is to be supplied to this mill this month, and definite information can then be obtained.

This subject of concentrates and concentrating is one I am deeply interested in, and I hope at no remote date to have the pleasure of reading a paper on that subject before this Association.

In conclusion I would advise every member who has a mill to build, to first visit Renfrew before he makes any plans, or lets any contracts.

*Read before the Gold Miner's Association, June 3, 1889.

Pennsylvania Miners' Wages.—From official returns received by the chief of the Bureau of Statistics of Pennsylvania, the wages of 20,000 miners employed at 130 collieries have been ascertained. The wages of the best paid miners amount over \$700 a year, and the lowest to \$200. The average in the anthracite and bituminous regions will be about \$500. A considerably lower figure is said to be earned in the bituminous.

MANUFACTURING NOTES.

New Works of the Dodge Wood Split Pulley Co., at West Toronto Junction.

We take much pleasure in giving special mention and a partial description of the above enterprising company's new works which have lately been erected at West Toronto Junction. The site selected is on the north side of the C. P. R. track, covering an area of some 4½ acres, which gives every facility for the shipping and receiving of stock, having special sidings for that purpose. The works, consisting of main building, 250x54, three stories, with annex 80x60, large store house, machine and blacksmith shops, &c., all of solid brick, having been erected especially for the manufacture of the Wood Split Pulley, and are completely equipped in the most modern and substantial manner.

Entering the annex we find the engine room, a model of completeness in itself, and are at once attracted by a beautiful and practical illustration of the transmission of power by manilla ropes, a system now very popular in the United States and Great Britain, and being largely adopted in this country through the efforts of this company who make that their specialty. The power is taken from the 13ft. grooved fly wheel of a handsome 100 H. P. compound engine, and conveyed to the 250 feet of main line shafting by means of 11 wraps of 5 rope running on to a 63 grooved pulley, which with the lighter pulley on travelling carriage and necessary idler and winder, constitute the main drive which runs the shaft at 300 revolutions per minute and drives all the machinery in the factory. In addition to the main drive there is a second transmission from engine shaft upright to counter shaft, from which is driven the mammoth Sturtevant fan. This fan, with the heater attachment, supplies all the hot air necessary for the heating and ventilation of the whole factory and dry kilns. It discharges 82,000 cubic feet of air per minute at 250 revolutions per minute, and requires 18 H. P. to drive it. The boiler is a "Field Stirling" water tube safety boiler, having a working pressure of 165 lbs. and 125 H. P. capacity. In this building we also find the dry house, which holds 60 M. feet of lumber, all on trucks of 4 M. feet each, and arranged so that as soon as a truck is passed out for use, a fresh one is pushed in from the other end, thereby keeping the kiln constantly full. The loaded truck of dried lumber is carried on an auxiliary car into west end of main building and deposited close to the large endless bed surface Planer and planed, then passed to the cutting up saws. We have now passed from annex into main building and are shown the direction in which the lumber travels after leaving the Planer. We find that all arm and bushing stock courses down one side of the large ground floor while the rim stock goes down the other side. In this way the work is systematically classified, each man and machine having his special portion of the pulley work to do. The pulley as it now appears, has reached the last end of first floor, and is taken on elevator to next floor, where it commences to travel westwards, passing through the different stages it arrives at west end of second floor, when we

find it a "Dodge Wood Split Pulley," ready for the paint shop. It is now taken in on Elevator (at that end for the purpose) to paint shop on 3rd floor, where it is thoroughly filled with a patent specially prepared filler, painted and varnished, and afterwards wrapped with special wood wrappers, size marked on end and is ready for shipment.

The machine shop is completely equipped for all iron work necessary in the making of iron centre grooved pulleys for rope transmissions, turning, shafting, bolt and nut cutting, tapping, smithing, etc.

The dust arrester and shaving service, which works most effectually, depositing into the vault in boiler room, is also worked with a Star-tant Fan.

The works throughout have been constructed with a view to being considered "Standard" by the Fire Insurance companies, all elevators and stairways being bricked in from ground to roof, and all doors iron covered. Each flat is provided with two fire plugs and 100 feet of 2 in. hose, also 3 bbls. and 20 pails kept constantly filled with salt water.

business, will be allowed thirty days trial and to return at the company's expense if then not found satisfactory."

The entire construction and fitting up of this model establishment has been under the direct supervision of Mr. Samuel May, the President and Manager, to whom too much praise cannot be given for his untiring zeal in placing his company in a position to supply the power users of Canada with an article which has long been so universally popular on the other side of the line.

Correspondence and orders should be directed to the office of the Dodge Wood Split Pulley Co., 89 and 111 Adelaide St., West, Toronto.

The Improved Davidson Mining Pump.

The Davidson Steam Pump for mining purposes has become a prime favorite. Simplicity, durability and efficiency are its prominent features, and recommend it for use wherever a thoroughly reliable pump is needed. Only the

repairs. The manufacturers claim that the valve will not get out of order, become deranged or wear out within the life of the pump. The valve is oscillated by an oblique cam, connected with the valve by a steel pin which passes through the valve into the exhaust port, in which the cam is placed.

The moving of the valve does not depend entirely upon the steam admitted to the end of the valve piston, for should that not be quick enough to operate on it with the pump under a high rate of speed, the cam is so constructed that it will carry the valve mechanically, and thus prevent the piston from striking the cylinder heads in any case. This is one of the most important features of the pump, the valve being as much under the control of the piston rod as the valve of the ordinary steam engine, worked by an eccentric, instead of being controlled by an auxiliary valve. Those of our readers requiring power pumps for mining purposes will do well to write for further particulars regarding the Davidson Improved Mining Pump. Address the makers; Davidson Steam Pump Co., 77 Liberty Street, N.Y., U.S.A.

Important to Iron Founders.

A new and important invention whereby Iron Founders can, without alteration of plant or, in fact, any departure from their present methods of moulding and pouring of the heated metal, secure a casting with a wrought iron or semi steel exterior. Besides not only a clean casting is secured, but one of a bright surface is given. The inventor, Mr. F. D. Taylor, M. E. of Brockville, Ont., after many years' experience, has, it is said, succeeded in accomplishing the above objects. It is known that in past years great strides have been made in improving and reducing the costs of both wrought iron and steel. But whilst these improvements have been going on little or no improvements of any note have been made in the foundry beyond that of running the iron into the ordinary sand and chill moulds. Mr. Taylor has invented a cheap lining which can be fitted into any mould and which, so soon as the molten iron comes in contact with it (during the process of pouring) reduces the carbon in the iron to its minimum, thereby producing a casting of increased strength and superior finish.

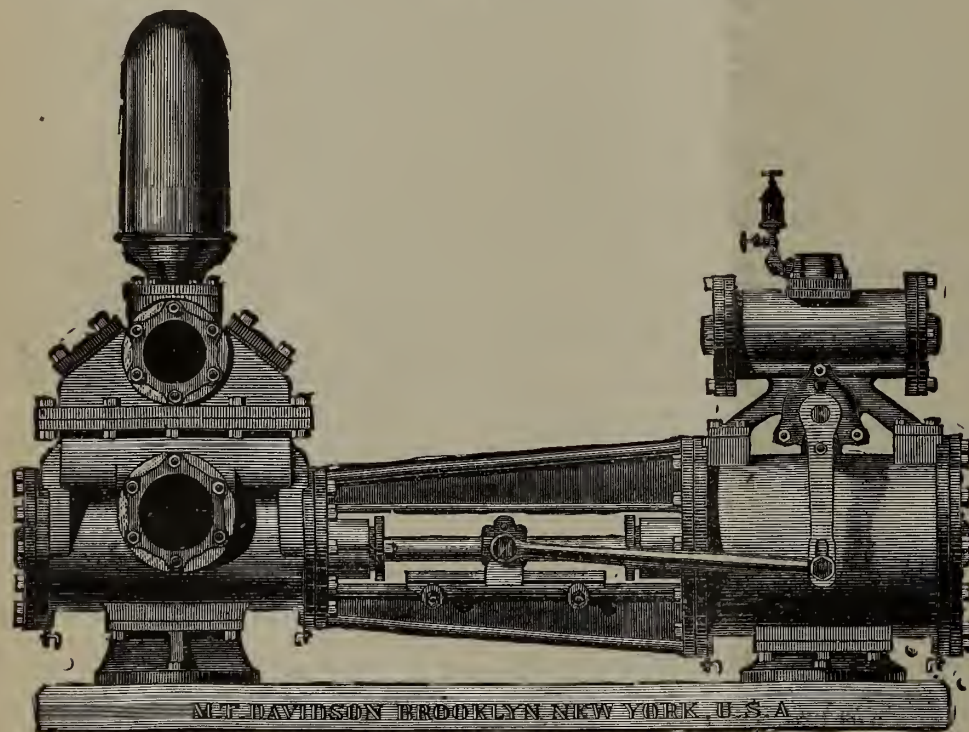
COAL MINING IN NOVA SCOTIA.

[Continued from May issue.]

By E. Gilpin, Jr., A.M., F.G.S., F.R.S.C., etc., Deputy Commissioner and Inspector of Mines for Nova Scotia.

At the head of the balance is placed a drum, having a powerful brake, and two ropes leading leading to the ballast tub and platform. The former being at the top of the balance, and the platform standing in a gap in the level railway or in a siding from it, a continuous track is obtained by the rails referred to on the platform. An empty tub being pushed on the platform it is evident that the road becomes self-acting, for the tub, at the top of the balance, on being loaded with ballast, will by its weight draw up the empty tub and platform. The platform can be arrested by means of the brake opposite the mouth of any of the bords which are driven similarly to those already referred to. There being a section of track in the bord, the empty tub is landed and replaced by one filled with coal. This additional weight causes the platform to descend and draw up the ballast box which is ready for another tub.

The pillar above the level is left 50 feet thick, and the bords start from the balance and run level for about 150 yards to the next balance. They are 15 to 18 feet wide, and 12 to 15 feet



THE IMPROVED DAVIDSON MINING PUMP.

The company holds eleven Canadian Patents, and the factory has a capacity of about two hundred pulleys per day without working overtime.

The article itself many of our readers have no doubt had an opportunity to try and benefit by the practical use of the Dodge Independence Wood Split Pulley, now a password in almost every factory and mill in the country. To those who have not used them we say get the company's special guarantee, which reads as follows:

"Every Pulley made shall be in every respect as represented. The maple face pulley in every case to transmit from 25 to 60 per cent more power with the same belt than any other iron pulley made with the like tension of belt. The compression fastening guaranteed to be perfect, the compression of wood and iron guaranteed to hold stronger than set screws in any case and to be the most perfect fastening ever invented. To summarize: Satisfaction entire guaranteed. Any Pulley found defective and not as represented may be returned at the expense of the company. Any party skeptical as to the merits of the Dodge Wood Split Pulley, and who means

best quality of material is used in its construction and the workmanship is admirable. In general appearance, as may be seen by engraving on this page, this pump is solid and substantial, simple and pleasing in design. Unlike other direct acting pumps, it has only one valve in the steam chest. This, which may properly be called a compound slide-valve with cylindrical face, performs two duties, that of the ordinary slide-valve and of the auxiliary valve combined. Its duty as a slide-valve is, of course, to reciprocate across the steam ports, to admit steam alternately to the two ends of the steam cylinder, and as an auxiliary valve, it is oscillated so as to open and close the steam ports that lead to the ends of the steam chest. The steam chest is cylindrical and bored out to make a face for the slide-valve and to receive the pistons that assist in operating the valve. The pistons are connected together, sufficient space being allowed between them for the valve and steam ports, and they are also connected to the slide-valve, all working in the same plane, and being of the same diameter, thus insuring evenness of wear and readiness of access for adjustment and

high, with pillars 35 feet thick, and cross cuts driven through into the next balance, and the first squared up, leaving a thin barrier of coal; but to gain time the next balance can be driven through the pillars of the bords of the first balance. The boxes are handled by the miners, and two boys can transfer the coal from a dozen bords to the level, without any assistance from horses, etc.

When the seam pitches at an angle heavier than 25° there are two modifications of this system that can be adopted. By one of them the track in the balance is done away with, and the coal tubs of each bord are emptied into the

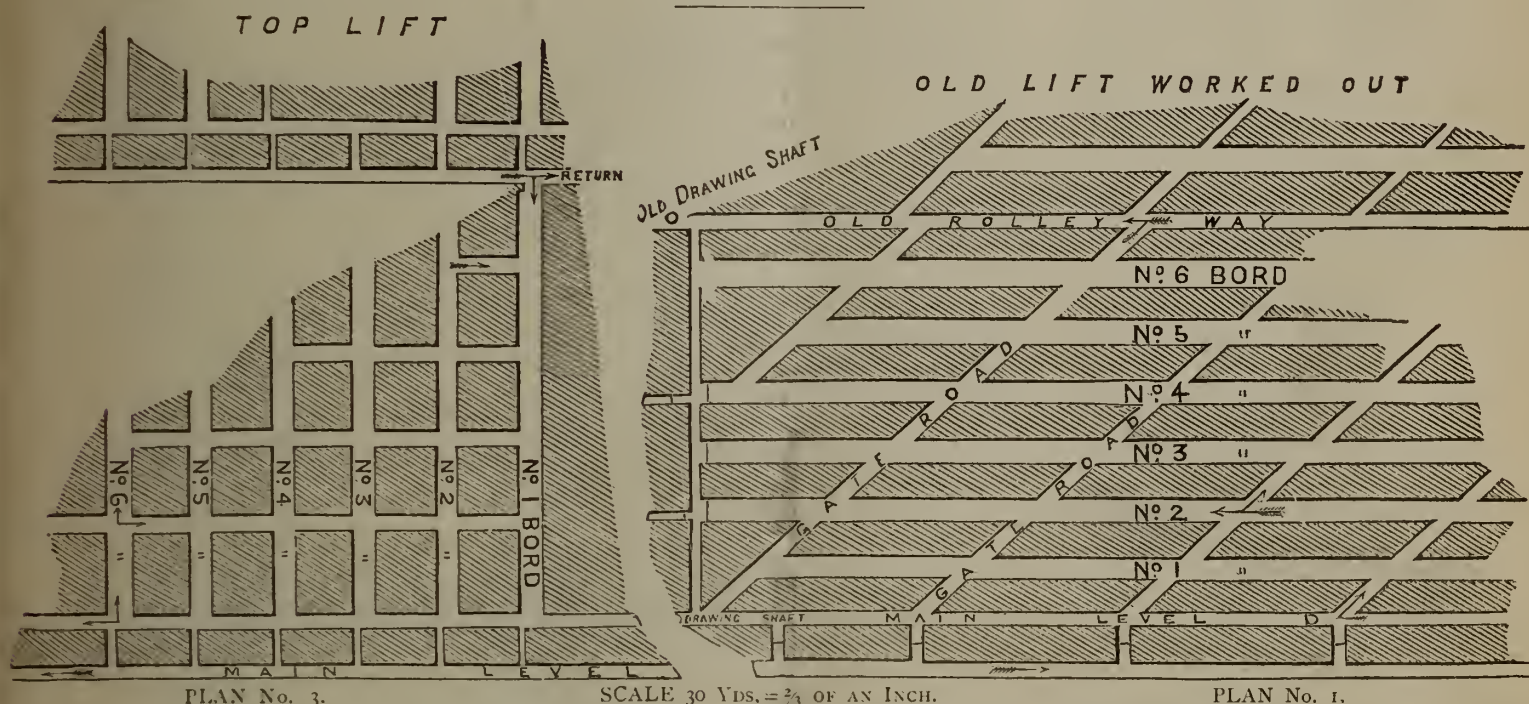
balance itself. In this case the coal will run either in the pavement or in a shoot made of iron sheets. At the point where the balance meets the level, the shoot is carried at a lessened angle so that it will project into the level at a height sufficient to allow the pit tubs to pass under its mouth. They are filled by lifting a door at the mouth of the shoot opened by the driver with the assistance of a lever. In the other modification the bords are driven directly to the rise from the level and a shoot laid in each one. The coal is loaded from the shoots on the level in the manner just described. This system has not been generally approved of from the difficulty of airing so many uphill places, and the

cost of getting timber to the faces, etc. On the other hand, the cost of material is less, there being no rails or tubs required in the bords, and the pillars are formed parallel to the dip of the seam.

In the Pictou and Cumberland districts, of late years, the seams, whenever local conditions permitted, have been opened by slopes. The slopes are usually driven in pairs, with one or more back slopes for ventilation. A crop pillar of two or three hundred feet being left, the first levels are turned away at a distance of six or seven hundred feet from the crop, and operations carried on as from a shaft. The slopes are driven wide enough to admit of a double track of

MAIN SEAM WORKINGS

PICTOU CO.



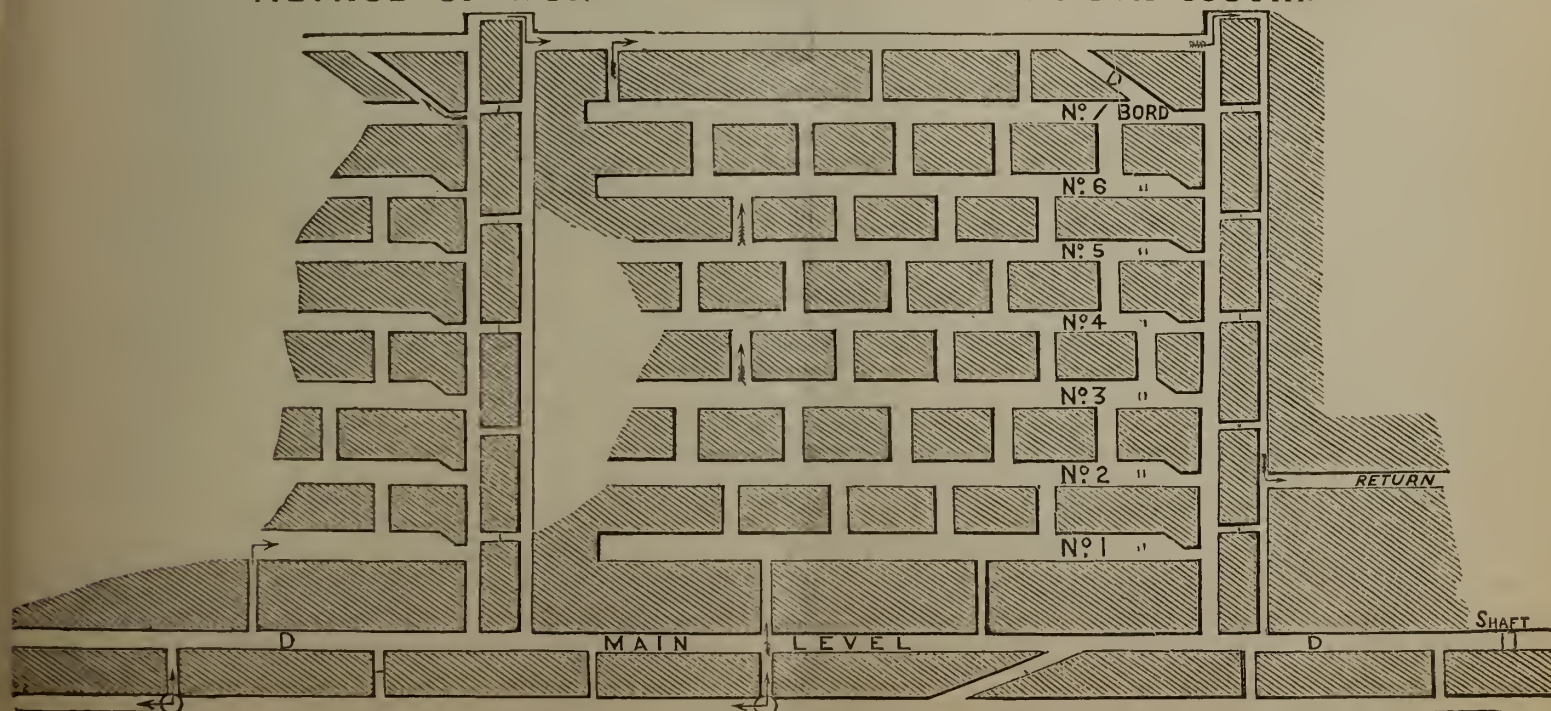
PLAN No. 3.

SCALE 30 YDS. = $\frac{2}{3}$ OF AN INCH.

PLAN No. 1.

This sketch shows the old method of working pitching seams referred to in May issue of this paper.

METHOD OF WORKING PITCHING SEAMS.—NOVA SCOTIA.



SCALE 30 YDS. = $\frac{2}{3}$ OF AN INCH.

PLAN No. 2.

the gauge of the pit tubs, usually from 1 foot 6 ins. to 2 ft. 6 ins., and provided with the usual switches. The signalling is done by wire signal cord striking a gong or giving a blow by means of a hammer on an iron plate. This method answers with a well stretched wire neatly hung and smartly handled, but electric signals would prove more satisfactory. The writer understands that the experience of H. S. Poole, Esq., agent, with electric signalling at the Acadia Colliery is so far satisfactory. Telephonic communication between the pit workings and the bank head has been tried, but at present is in operation only at the Vale Colliery. There is an arrangement made at some mines, whereby the ascending train of loaded tubs by striking a lever a few yards before the bankhead is reached rings a bell in the engine room and cautions the engine tender. To prevent the empty tubs from running down the slope should they escape the bankman's hands, a weighted lever is placed at the head of the slope, between the rails of the track for the empty tubs. When at rest, the unweighted end rises above the rails so as to engage with any descending tubs, while it offers no obstacle to the passage of ascending tubs, which are heavier than the weighted end.

In the flatter lying seams of Cape Breton, the methods of winning and working the coal do not differ materially from those common in England. Usually the levels are driven in pairs from the shaft bottom. Gate or horse roads are turned away from them, and the bords opened out of the horse roads at such angles as may best suit the requirement of the mine. As the bords advance the gate road is frequently turned up the first bord until it reaches a point near the working faces, when it resumes its normal course, so as to shorten haulage.

At the Gowrie Colliery bords are driven eleven yards wide and the pillars left seven yards thick. When the bord is first started a road is laid on each side, and the dirt, etc., are stowed in the centre. Afterwards a cut is made through the stowage, and the double road maintained only at the face. By this system under a moderate cover, the maximum of coal is got at the first operation, and the drawing of the pillars when the rooms have gone their distance, should give a good pillar coal with little danger of creep.

Pillaring.—The shape and size of pillars varies with the depth of the seam, and the nature of the roof. The earliest workings along the crops of the seams left small square pillars, which have frequently crushed and caused trouble by the admission of surface waters.

At Springhill between the 1,300 and 1,900 feet levels, the main "level pillar" is 100 feet thick, then succeed 12 feet bords, with 35 feet pillars, with the middle pillar of the balance 50 feet thick. There are seven bords on each balance, and the block of coal between the 1,300 and the 1,900 feet level is 550 feet wide. The loss of coal in working the bords and heads is about 18 per cent, and when taking out the pillars the loss is 15 to 20 per cent. in the high coal (9-14 feet), and in the low coal (4 feet thick) about 5 per cent. At the Albion Colliery, when working nine to fifteen feet of the upper part of the main seam at a depth of 90 feet, the bord pillars were left 35 feet wide and from 75 to 100 feet long, the level pillars being a little thicker.

In Cape Breton, at the Sydney (main seam) workings, in the earlier mining, the bords were 6 or 7 yards wide, and the pillars 10 by 14.5 yards. In the Queen Pit workings, 360 feet deep, the bords were 5½ yards wide. In the present workings, 600 to 800 feet deep, the size

of the bords has not been altered, but the pillars have been made a little larger.

The examples will serve to show the practice generally adopted. In a few collieries the extraction of pillars is systematically carried on, and usually closely follows the completion of a panel of bord and pillar workings. No regular rule has been laid down for the initiation and conduct of the operation. In some mines, as soon as the workings of any lift are finished, the pillars are drawn back; in others the pillars of each balance or shoot are drawn to suit the trade. The experience so far gained is in favor of former practice. Frequently, the extraction is so arranged, that the upper pillars are worked in advance of the lower ones, under a belief that by this means the roof is most readily let down and settled. In other cases the line of the full dip is taken as the range of the working faces.

The top and bottom pillars, forming the high and low sides of the levels of the various lifts, are allowed to remain untouched, in order to provide for drainage, etc., or the bottom pillar, immediately above the main level, is left to be taken out in the extraction of pillars in the next lift, whenever there is other provision made for air, etc. The pillars are either attacked from the lower end next the goaf, and carried back the full width, or a head is driven into the pillar and widened out sideways, first toward the goaf and then backward. The aim is to allow the roof to fall as quickly and completely as possible, to prevent weight from being thrown down-hill on the levels or any lower workings, and the timbering is proportioned so as to afford protection only for the removal of the succeeding pillar. But it will be understood that in steep seams, with questionable roof, having a thickness of from 10 to 15 feet, no hard and fast rule can be carried out.

In the flat lying seams of Cape Breton, little pillar work has been done except at the Caledonia Colliery, where the pillars lying under a pressure of 100 to 200 feet, and of good dimensions, have been successfully drawn.

In many cases, however, the pillaring has been viewed rather from the standpoint of a support to the roof than as a future supply of coal. The great question is that of water, and no doubt in many of the Cape Breton collieries worked at shallow depths, the increased pump costs would, at the present price of coal, outweigh any gain from the cheapness with which it can be mined in comparison with bord coal.

At present the most advanced mining practice in the province, is in favor of moderate sized pillars, to be drawn at the earliest possible moment. Even adopting this principle, except in a case of a few mines, the conditions of trade are unfavorable to extended and systematic pillar workings at considerable depths, for the shipments are interrupted during the depth of winter. When pillars are not taken out, the percentage of coal removed may vary between 25 and 35 per cent., when they are drawn, as high as 90 per cent. of the seam has been gained.

In Cape Breton the coal lying, as already mentioned, at easy angles is attacked through shafts, except at the Victoria and Reserve collieries. At the Victoria mine, at Low Point, the seam lies a heavy angle. Here two slopes spread out on the half pitch of the seam, and have, intermediate between them, one driven on the full pitch of the seam. This is used for ventilation and pumping, and will ultimately serve for the tail ropes of a system of haulage, which will pick up the tubs in the level and haul them direct to bank. The empty tubs running down the slopes by their own weight, will be taken

along the levels by the tail ropes. This arrangement will do away with the level horses. The balance system has been adopted here.

At the Reserve mine the seam was opened by a slope, but the mining wisdom of this procedure is doubtful, the seam lying at so low an angle that the empty tubs are landed with difficulty at the bottom of the slope. In order to provide more pit room, at a point in the slope, about ten chains from its mouth, a steeper slope, having an inclination of one in three and a half, has been driven to intersect the Emery seam lying 95 feet below the one at present worked. The following table shows the depth of the main shafts of the principal collieries:—

Sydney,	681 feet.	Round diameter 13 ft.
International,	87 "	14.5 by 16.5 ft.
Glace Bay,	224 "	10.5 by 11 ft.
Caledonia,	205 "	11 by 11 ft.
Gowrie,	260 "	11.5 feet diameter.

At the Sydney mines of the General Mining Association is found the largest shaft plant working in the Province. The main pump and back shafts were sunk under unusual difficulties from heavy feeders of water. The shafts are situated at the Northern point of Sydney Harbor, a few yards from the sea shore, and were intended to command the coal in an area of four square miles extending under the sea. At a depth of 200 feet heavy feeders of salt water reaching 1800 gallons per minute were met, and after severe exertions they were stopped by cast iron tubbing.

The following memorandum of tubbing used in the new shafts will be of interest:—

	Depth tubbed,	Segments,	Weight lbs.
Winding shaft,	275 ft. 6 in.	1269	658,724
Pumping "	284 ft. "	1168	569,639
Staple "	283 ft. 3 in.	736	323,975
			1,552,338

Underground, two large engines stand near the shaft bottom, and draw the coal along a rise engine plane with dip slants. The rope on the main level is an endless one. The train of full tubs starting from the landing near the face of the plane run by gravity to the pit bottom, and the train of empties is, drawn out by the tail rope. By means of square ropes lying in the dip slants, this system can be extended in any direction, and has been found to work satisfactorily for a number of years. Under this arrangement, horses are used only to collect and distribute the tubs from the landings and working falls, and their employment for the long level haulage, which is over a mile on one side of the pit, is avoided.

At the International mine the coal to the rise of the shaft (80 feet deep) having become exhausted, a slope was driven from a point a few yards to one side of the shaft, on the full dip of the seam, for a distance of about 2,500 feet, and at an inclination of 5½°. The engine stands at bank and is signalled from the foot of the slope. The track is of the ordinary character, and a double rope being used, the employment of an automatic switch allows the train of empty tubs to pass the full ones, irrespective of the landing they are being drawn from.

At the Caledonia mine a portable engine and boiler have been placed underground at the head of the slope driven to the full dip. The smoke is led into the return. The system of raising steam underground is open to objections. Precautions are taken to remove the soot, and to lessen its liability to combustion, but any fire underground is a standing menace to a mine.

The writer is pleased to learn that preparations are being made to generate the steam, for the underground haulage at the surface, as such an

arrangement must add to the safety of the pit.

At the Gowrie mine the haulage from the dip slant is conducted on a system resembling that referred to as adopted at the International.

The tables of machinery will give full particulars as to size of engines above and below ground, their loads, steam supply, etc.

VENTILATION.

The furnace was employed for ventilating the Nova Scotia mines, until a change was made in 1871, by the introduction of a Guibal Fan at the Albion mines. This fan was ten feet wide, and thirty feet in diameter, and yielded 75,000 cubic

feet per minute at 47 revolutions, being driven by a direct acting engine having a 24 in. stroke, and 24 in cylinder. The length of air ways was about 15,000 feet. Afterwards fans were introduced at the Sydney, Intercolonial, Low Point, and Springhill collieries. At the latter the seams being inclined and close together, it was found practicable to use "blow down" fans placed directly over the downcast and driven by a belt, so as to air the mine in sections having comparatively short airways. The volumes of air in cubic feet passed per minute by these fans vary from 15,000 to 89,000. The highest record being that of the Intercolonial colliery, which during the year 1887 maintained an ave-

rage monthly circulation of about 85,000 cubic feet.

In Cape Breton at the Reserve, International, Caledonia, and Gowrie mines, furnaces are still used, but the rapid extension of the workings of these collieries during the past few years, renders a more efficient ventilating power imperative. At one mine only, the Gowrie, is there any opportunity given for the furnace to do proper duty. Here it is placed near the bottom of the drawing shaft, being connected with it by an ascending drift, which enters the shaft above the door heads.

Its dimensions are, length of bars 7 feet, height of bars above floor 2 ft. 6 in., width of bars 7 ft. 8 in., length of heated column 307 feet, height of crown of arch above bars, 5 feet.

The total length of air course is about 170,000 feet, least sectional area, 56 ft., average sectional area, 64 ft. There are two air courses, 8,000 and 9,000 feet long. This furnace passes on an average, 44,000 cubic feet of air per minute, with a consumption of about 1½ tons of coal during the twenty-four hours. The capacity of the furnace could be increased to about 50,000 feet if required.

At the other mines, wooden chimneys fifty to eighty feet high have been placed on the shallow crop pits, which were first used for ventilating, but as the efficiency of the furnace increases in a ratio much smaller than the increase in length of the upcast, these additions give little assistance. The furnaces are of the usual pattern, being of brick, with arched roof, and having the grate about 2 feet from the floor, about 6 feet wide, and 9 feet long. The volumes of air passed vary from 20,000 to 43,000 per minute, the consumption of coal varying from one to two and a quarter tons a day.

The furnace under favoring conditions of large grate area, roomy air ways, and a long heated column, forms an efficient ventilator, but the last named condition in our mines is but partially presented at the Gowrie colliery. At present, they are operated under conditions which should lead to the prompt replacement of the furnace system by mechanical ventilators.

The cost of the latter, if one of the smaller and semi-portable patterns be adopted, is but little larger, and it yields a much greater efficiency on the basis of coal consumption. Its work can be constantly supervised, its maximum capacity readily reached, and in case of accident if it be properly placed, it is readily available for renewing the ventilation of the patterns adopted here. The Guibal has most satisfactorily stood the test of steady and long continued

(To be Continued.)

MONEY ORDERS.

MONEY ORDERS may be obtained at any Money Order Office in Canada, payable in the Dominion; also in the United States, the United Kingdom, France, Germany, Italy, Belgium, Switzerland, Sweden, Norway, Denmark, the Netherlands, India, the Australian Colonies, and other countries and British Colonies generally.

On Money Orders payable within Canada the commission is as follows:

If not exceeding \$4.....	2c.
Over \$4, not exceeding \$10.....	5c.
" 10, " " 20.....	10c.
" 20, " " 40.....	20c.
" 40, " " 60.....	30c.
" 60, " " 80.....	40c.
" 80, " " 100.....	50c.

On Money Orders payable abroad the commission is:

If not exceeding \$10.....	10c.
Over \$10, not exceeding \$20.....	20c.
" 20, " " 30.....	30c.
" 30, " " 40.....	40c.
" 40, " " 50.....	50c.

For further information see OFFICIAL POSTAL GUIDE.

Post Office Department, Ottawa.
15th Sept., 1888.



SEALED TENDERS addressed to the undersigned, and endorsed "Tender for supplying Coal for the Public Buildings, Ottawa," will be received at this office until THURSDAY, 11th JULY next.

Specifications can be seen and forms of tender obtained on and after Friday, the 21st June, at this office, where all necessary information can be had on application, also at the office of James Nelson, Architect, Montreal, and at the Dominion Public Works Office, Post Office, Quebec.

Each tender must be accompanied by an accepted bank cheque for the sum of \$30, made payable to the order of the Honourable the Minister of Public Works, which will be forfeited if the party decline to enter into a contract when called upon to do so, or if he fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
A. G. BEIL,
Secretary.

Department of Public Works,
Ottawa, 11th June, 1889.



JAMES S. NOAD, MINING AGENT

AND PROMOTER OF AND DEALER IN

Mines and Mining Properties,
MONTREAL, CANADA.

MINES AND MINING PROPERTIES.

The undersigned, representing a London Syndicate, is prepared to negotiate for desirable Mines and Mining Properties, for the purpose of forming them into Joint Stock Companies, or providing cash capital for their proper development.

Address or call on
JAMES S. NOAD,
Montreal.

JAMES S. NOAD, MINING AGENT

AND PROMOTER OF AND DEALER IN

Mines and Mining Properties,
MONTREAL, CANADA.



ASBESTOS Cloths, Pacings, Furnace Cements, Paper, Stove Linings, &c.

SPECIALTIES: FIREFELT, a flexible Asbestos Sheet, made in tubular sections and rolls, best and most durable non-conductor made. SUPERATOR, a strong fire & waterproof fabric for sheathing & roofing buildings, fire proofing boiler rooms, &c.

THE CHALMERS-SPENCE CO.,
419 TO 425 EIGHTH ST., NEW YORK.

ASBESTOS.

CRUDE AND MANUFACTURED FOR ALL PURPOSES.

POSITION WANTED.

A practical Certificated Colliery Manager is open for engagement. Twenty years experience in every system of Coal Mining in some of the largest collieries in the North of England and in Nova Scotia. Large experience in sinking and timbering shafts.

Address:

COLLIERY MANAGER,
Canadian Mining Review,
Ottawa, Ont.

FOR SALE.

Asbestos Mines.

On Lots 27, 28 and 29, in Range A, of Colrairie, Megantic County, P. Q.

300 ACRES,

One Mile from Quebec Central Railway.
Free from Reserves or Royalties.

James Reed,
Reedsdale, Megantic, P. Q.

RUSSELL & CO.

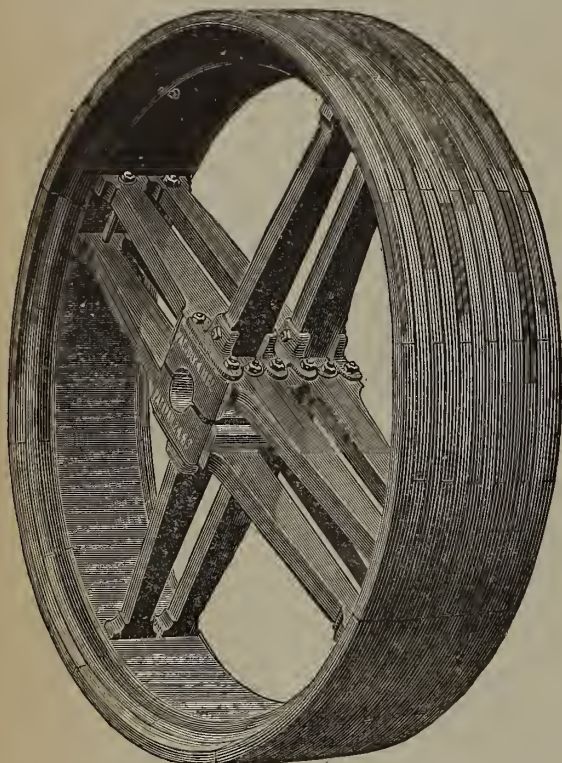
PROVINCIAL AND DOMINION

LAND SURVEYORS,
CIVIL AND MINING ENGINEERS,
PORT ARTHUR, ONTARIO.

Mining Properties Surveyed, Reported on and Dealt in.

Latest and Most Complete Plans of Thunder Bay Mining District Always on Hand.

A. L. RUSSELL, A. H. MACDOUGLL, W. W. RUSSELL
P. L. S., D. L. S. P. L. S., D. L. S. M.E.A. MCAN. SOC. C.E.



DODGE PATENT

Wood Separable Split Pulleys

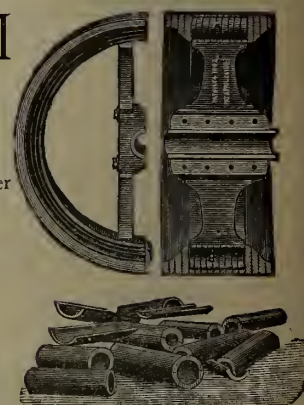
Best Belt Surface, Lightest, Strongest, Best Balanced and Most Convenient Pulley in the World.

WITH OUR PATENT BUSHING SYSTEM

In Comparing Prices of Pulleys please note carefully the following:

1. Our list is lower than most others.
2. Every Pulley is a Split Pulley.
3. Every Pulley is guaranteed to transmit from 25 to 60 per cent. more power than an iron one with same tension of belt.
4. Our Pulleys are 70 per cent. lighter than iron pulleys.
5. The fastening does not mar the shaft.
6. They are perfect in Balance.
7. They can be used on many different sizes of shafting.
8. They are the most thoroughly made wooden pulleys in the world.
9. And the handsomest pulley on the shaft.
10. No chances to take. Every pulley as represented or no sale.

Order a Sample Pulley, after which you will have no other.



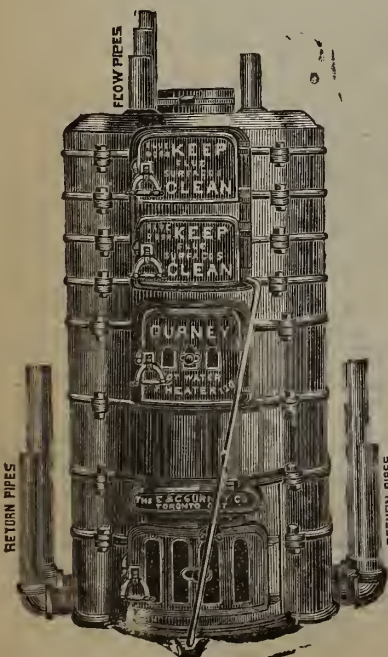
EVERY PULLEY IS A SPLIT PULLEY
Made in any size from 9 inches to 16 ft. diameter with original bores of 3 and 3½ inches, bushings to be used for intermediate sizes; larger ones bored to order.

WE ALSO MANUFACTURE
WOODEN GROOVED PULLEYS FOR THE TRANSMISSION OF POWER
BY MANILLA ROPE,

Under the Dodge Patent System from 5 to 500 h. p. State power to be transmitted, speed of shafts, relative position of shafts, distance between shafts, and we can furnish a clear estimate.

EVERY PULLEY WILL FIT.
22 or more sizes of Shafting.
200 of our Pulleys and an assortment of bushings represent as many as 4,000 iron pulleys, a great advantage to dealers carrying stock.

APPLY FOR PARTICULARS TO **The Dodge Wood Split Pulley Co., 81 & 111 Adelaide Street West, Toronto.**



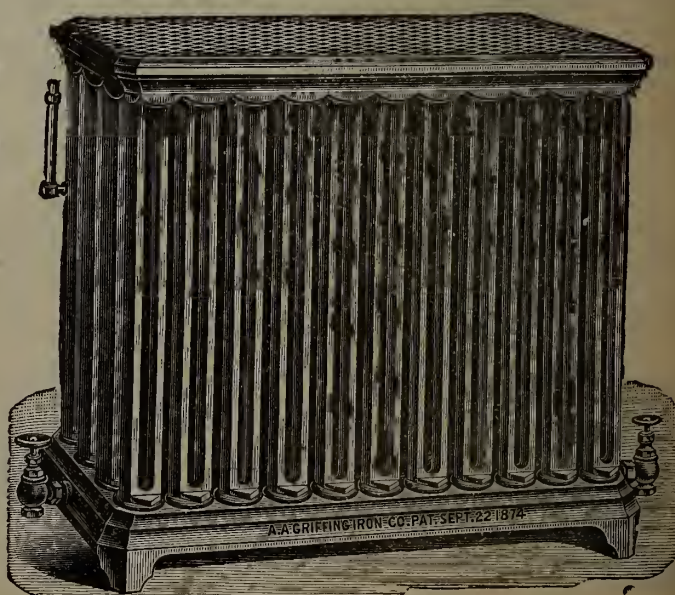
USE GURNEY'S IMPROVED CELEBRATED Hot Water Heaters!

Guaranteed more Economical than any other Heater now made, and containing every known Improvement in Hot Water Heating.

STEAM FITTINGS, CAST IRON PIPE, REGISTER, GRATES, ETC.

HOT AIR FURNACES FOR COAL OR WOOD.

E. & C. GURNEY & CO.,
MONTREAL.



Bundy Radiators for Quick Circulation and Economy of Space.

VALUABLE PLUMBAGO

AND OTHER

Mineral Lands FOR SALE,

IN THE TOWNSHIP OF BUCK-
INGHAM, COUNTY OF
OTTAWA.

1st.—Lot 28, in the 6th range, containing 100 acres, in addition to the salina of the lake.

2nd.—North half of lot 23, in the 5th range, containing 100 acres.

3rd.—Nine acres of lot No. 28, in the 5th range, with water privileges thereto appertaining, being site of mill dam, etc., etc.

The property formerly belonged to the Montreal Plumbago Mining Company, and was worked successfully for several years, until the company's mill was destroyed by fire, but the mill dam remains almost uninjured, and there are on the property several houses, sheds, etc., built for various purposes when mining operations were carried out.

The Plumbago Deposits

upon the property are regarded as amongst the richest and most extensive in the Dominion. As to the quality of the Plumbago, it has been extensively used in the manufacture of crucibles, lubricating leads, stove polish, etc., etc., and given unbounded satisfaction. This is established by the experience of consumers, and by a certificate from the celebrated Battersea Crucible Works, London, England, a copy of which is open for inspection.

MICA

has also been discovered in quantity

The lands are in the Phosphate region, and recent prospecting has disclosed a rich and extensive deposit of this mineral. There are unrivalled facilities for transporting the ore to and from the mines by the Ottawa River and C. P. Railway. Distance from mines to Railway Station 6 miles. Good road.

All that is required to make these valuable mines handsomely remunerative is a little capital and enterprise.

The Title is Indisputable.

For information apply to

WM. H. DICKSON,
160 Waller St., Ottawa.

H. E. DICKSON,
Russell House, Ottawa.

OR TO THE OFFICE OF

THE CANADIAN MINING REVIEW.
OTTAWA.

SHIPMAN ENGINES, ACME MODEL. COAL OIL FOR FUEL.



To parties requiring a safe, reliable, durable and economical Steam Launch, from 12 to 35 x 7 with ample power to give satisfactory speed, we can supply the best on the market and at prices which will defy competition for a like quality of goods. We have a full staff of competent boat and engine builders and guarantee every article to be strictly first class. Hundreds of our engines from 1 to 12 h. p. Marine or Stationary have been in use for years and are acknowledged superior to all others. No smoke, dirt or sparks, no manual or mechanical labor necessary. You have the privacy of your launch for your family. As the water and oil supply is automatic very little attention is required. But a few minutes is necessary to get up 100 lbs. of steam; when you return to the boat house by turning a hand wheel all fire is extinguished. Orders for coming season should be placed at once, as the demand is much in excess of previous years. Write for 1889 circulars giving prices, testimonials, etc. No attention paid to postal cards.

JOHN GILLIES & CO., Carleton Place, Ont.



FOR—

Mines, Elevators, Inclines, &c.

GALVANIZED GUY ROPE. BRIDGE CABLES.
HAWSER ROPES.

WIRE of all kinds. Insulated WIRES

John A. Roebling's Sons Co.

117 & 119 LIBERTY St., NEW YORK.

H. L. SHIPPY Sec'y.

PHOSPHATES, PHOSPHATIC MANURES, AGRICULTURAL FERTILIZERS

Readers of the REVIEW desiring extra copies of SCIENTIFIC AGRICULTURE should SEND IN THEIR ORDERS NOW. A few SPACES are still open and contracts may be made at reasonable rates. Address Manager, THE CANADIAN MINING REVIEW, OTTAWA.

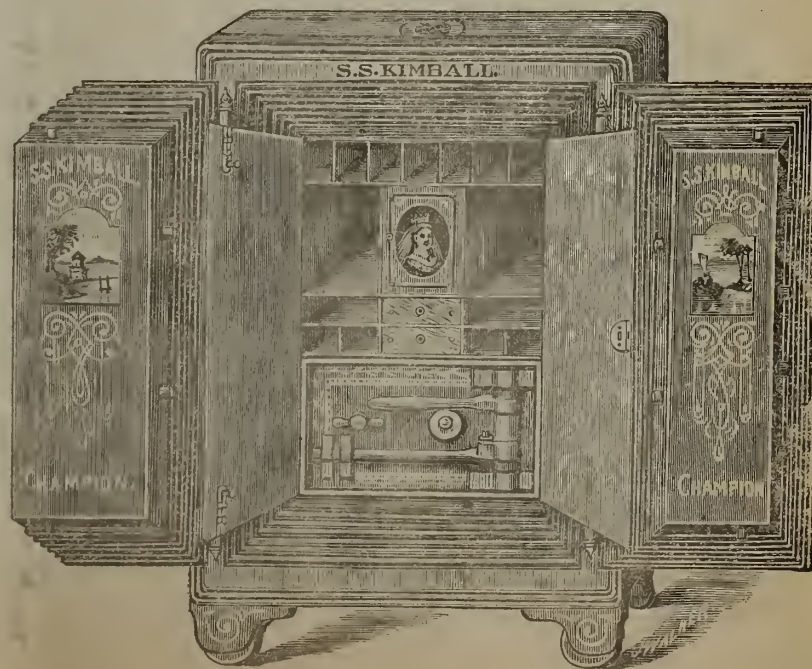
Champion Fire and Burglarproof Safes.

These Safes have the best record of any in the Dominion. Price 30 per cent. cheaper than any other first-class Safe.

SEND FOR CATALOGUE AND PRICE-LIST.

S. S. KIMBALL,

577 Craig St., Montreal.





DEPARTMENT OF Inland Revenue.

AN ACT RESPECTING AGRICULTURAL FERTILIZERS.

The public is hereby notified that the provisions of the Act respecting AGRICULTURAL FERTILIZERS came into force on the 1st of January, 1886 and that all Fertilizers sold thereafter require to be sold subject to the conditions and restrictions therein contained—the main features of which are as follows:

The expression "fertilizer" means and includes all fertilizers which are sold at more than TEN DOLLARS per ton, and which contains ammonia, or its equivalent of nitrogen, or phosphoric acid.

Every manufacturer or importer of fertilizers for sale, shall, in the course of the month of January in each year, and before offering the same fertilizer for sale, transmit to the Minister of Inland Revenue, carriage paid, a scaled glass jar, containing at least two pounds of the fertilizer manufactured or imported by him, with the certificate of analysis of the same, together with an affidavit setting forth that each jar contains a fair average sample of the fertilizer manufactured or imported by him; and such sample shall be preserved by the

Minister of Inland Revenue for the purpose of comparison with any sample of fertilizer which is obtained in the course of the twelve months then next ensuing from such manufacturer or importer, or collected under the provisions of the Adulteration Act, or is transmitted to the chief analyst for analysis.

If the fertilizer is put up in packages, every such package intended for sale or distribution within Canada shall have the manufacturer's certificate of analysis placed upon or securely attached to each package by the manufacturer; if the fertilizer is in bags it shall be distinctly stamped or printed upon each bag; if it is in barrels, it shall be either branded, stamped or printed upon the head of each barrel or distinctly printed upon good paper and securely pasted upon the head of each barrel, or upon a tag securely attached to the head of each barrel; if it is in bulk, the manufacturer's certificate shall be produced and a copy given to each purchaser.

No fertilizer shall be sold or offered or exposed for sale unless a certificate of analysis and sample of the same shall have been transmitted to the Minister of Inland Revenue and the provisions of the foregoing sub-section have been complied with.

Every person who sells or offers or exposes for sale any fertilizer, in respect of which the provisions of this Act have not been complied with—or who permits a certificate of analysis to be attached to any package, bag or barrel of such fertilizer, or to be produced to the inspectors to accompany the bill of inspection of such inspector, stating that the fertilizer contains a larger percentage of the constituents mentioned in sub-section No. 11 of the Act than is contained therein—or who sells, offers or exposes for sale any fertilizer purporting to have been inspected, and which does not contain the percentage of constituents mentioned in the next preceding section—or who sells or offers or exposes for sale any fertilizer which does not contain the per-

centage of constituents mentioned in the manufacturer's certificate accompanying the same, shall be liable in each case to a penalty not exceeding fifty dollars for the first offence, and for each subsequent offence to a penalty not exceeding one hundred dollars. Provided always that deficiency of one per centum of the ammonia, or its equivalent of nitrogen, or of the phosphoric acid, claimed to be contained, shall not be considered as evidence of fraudulent intent.

The Act passed in the forty-seventh year of Her Majesty's reign, chaptered thirty-seven and entitled, "*An Act to prevent fraud in the manufacture and sale of agricultural fertilizers*," is by this Act repealed, except in regard to any offence committed against it or any prosecution or other act commenced and not concluded or completed, and any payment of money due in respect of any provision thereof.

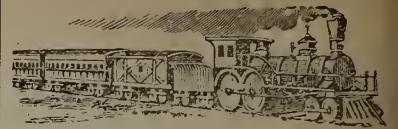
A copy of the Act may be obtained upon application to the Department of Inland Revenue, as well as a copy of a Bulletin which it is proposed to issue in April, 1888, concerning the fertilizers

E. MIALI,
Commissioner.

January, 1889.

PROPERTIES FOR SALE.

Parties having developed or undeveloped mineral lands for sale will find the REVIEW an admirable medium for bringing them before the notice of CAPITALISTS and INVESTORS in GREAT BRITAIN and the UNITED STATES.



THE Intercolonial Railway

OF CANADA.

The Royal Mail Passenger & Freight
Route between Canada and
Great Britain,

—AND—

Direct route between the West and all points on the Lower St. Lawrence and Baie des Chaleurs; also New Brunswick, Nova Scotia, Prince Edward Island, Cape Breton and Newfoundland.

New and Elegant Buffet Sleeping and Day Cars run on through Express Trains.

Passengers for Great Britain or the Continent by leaving Toronto by 8 00 A.M. train Thursday will join Outward Mail Steamer at Halifax Saturday.

Superior Elevator, Warehouse and Dock accommodation at Halifax for shipment of grain and general merchandise.

Years of experience have proved the Intercolonial, in connection with steamship lines to and from London, Liverpool and Glasgow to Halifax, to be the quickest freight route between Canada and Great Britain.

Information as to Passenger and Freight rates can be had on application to

E. KING,
27 Sparks Street,
OTTAWA.

G. W. ROBINSON,
Eastern Passenger Freight Agent,
137½ St. James St., MONTREAL

D. POTTINGER,
Chief Superintendent.

Railway Offices, Moncton, N.B.
Nov. 20th, 1888.

The Polson Iron Works Co'y TORONTO, ONT.

Manufacturers of the Celebrated "Brown
Automatic Engine."

GENERAL DEALERS IN

MINING MACHINERY.

SPECIAL AGENTS FOR

Knowles' Steam Pumps,

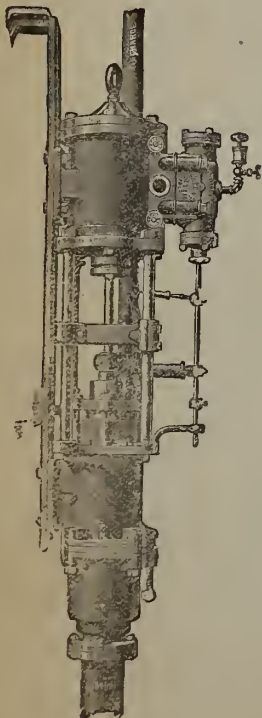
B. T. Sturtevant's Blowers and Fans,

Burleigh Rock Drills.

Hoisting Engines and Boilers, Quartz Mills, Diamond Prospecting Drills, Rock Breakers.

Office and Works, Esplanade E.; Warehouse, 38 Yonge St.,

TORONTO.





Mining Regulations

TO GOVERN THE DISPOSAL OF

Mineral Lands other than Coal Lands, 1886.

THESE REGULATIONS shall be applicable to all Dominion Lands containing gold, silver, cinnabar, lead, tin, copper, petroleum, iron or other mineral deposits of economic value, with the exception of coal.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein, either by surface or subterranean prospecting for mineral deposits, with a view to obtaining under the Regulations a mining location for the same but no mining location or mining claim shall be granted until the discovery of the vein, lode or deposit of mineral or metal within the limits of the location or claim.

QUARTZ MINING

A location for mining, except for iron on veins, lodes or ledges of quartz or other rock in place shall not exceed forty acres in area. Its length shall not be more than three times its breadth and its surface boundary shall be four straight lines, the opposite sides of which shall be parallel, except where prior locations would prevent, in which case it may be of such a shape as may be approved of by the Superintendent of Mining.

Any person having discovered a mineral deposit may obtain a mining location therefor, in the manner set forth in the Regulations which provides for the character of the survey and the marks necessary to designate the location on the ground.

When the location has been marked conformably to the requirements of the Regulations, the claimant shall within sixty days thereafter, file with the local agent in the Dominion Land Office for the district in which the location is situated, a declaration or oath setting forth the circumstances of his discovery, and describing, as nearly as may be, the locality and dimensions of the claim marked out by him as aforesaid; and shall, along with such declaration, pay to the said agent an entry fee of FIVE DOLLARS. The agent's receipt for such fee will be the claimant's authority to enter into possession of the location applied for.

At any time before the expiration of FIVE years from the date of his obtaining the agent's receipt it shall be open to the claimant to purchase the location on filing with the local agent proof that he has expended not less than FIVE HUNDRED DOLLARS in actual mining operations on the same; but the claimant is required, before the expiration of each of the five years, to prove that he has performed not less than ONE HUNDRED DOLLARS' worth of labor during the year in the actual development of his claim, and at the same time obtain a renewal of his location receipt, for which he is required to pay a fee of FIVE DOLLARS.

The price to be paid for a mining location shall be at the rate of FIVE DOLLARS PER ACRE, cash, and the sum of FIFTY DOLLARS extra for the survey of the same.

No more than one mining location shall be granted to any individual claimant upon the same lode or vein.

IRON.

The Minister of the Interior may grant a location for the mining of iron, not exceeding 160 acres in area which shall be bounded by north and south and east and west lines astronomically, and its breadth shall equal its length. Provided that should any person making an application purporting to be for the purpose of

mining iron thus obtain, whether in good faith or fraudulently, possession of a valuable mineral deposit other than iron, his right in such deposit shall be restricted to the area prescribed by the Regulations for other minerals, and the rest of the location shall revert to the Crown for such disposition as the Minister may direct.

The regulations also provide for the manner in which land may be acquired for milling purposes, reduction works or other works incidental to mining operations.

Locations taken up prior to this date may, until the 1st of August, 1886, be re-marked and re-entered in conformity with the Regulations without payment of new fees in cases where no existing interests would thereby be prejudicially affected.

PLACER MINING.

The Regulations laid down in respect to quartz mining shall be applicable to placer mining as far as they relate to entries, entry fees, assignments, marking of localities, agents' receipts, and generally where they can be applied.

The nature and size of placer mining claims are provided for in the Regulations, including bar, dry, bench, creek or hill diggings, and the RIGHTS AND DUTIES OF MINERS are fully set forth.

The Regulations apply also to

BED-ROCK FLUMES, DRAINAGE OF MINES AND DITCHES.

The GENERAL PROVISIONS of the Regulations include the interpretation of expressions used therein; how disputes shall be heard and adjudicated upon; under what circumstances miners shall be entitled to absent themselves from their locations or diggings, etc., etc.

THE SCHEDULE OF MINING REGULATIONS

Contains the forms to be observed in the drawing up of all documents such as:— "Application and affidavit of discoverer of quartz mine." "Receipt for fee paid by applicant for mining location." "Receipt for fee on extension of time for purchase of a mining location." "Patent of a mining location." "Certificate of the assignment of a mining location." "Application for grant for placer mining and affidavit of applicant." "Grant for placer mining." "Certificate of the assignment of a placer mining claim." "Grant to a bed rock flume company." "Grant for drainage." "Grant of right to divert water and construct ditches."

Since the publication, in 1884, of the Mining Regulations to govern the disposal of Dominion Mineral Lands the same have been carefully and thoroughly revised with a view to ensure ample protection to the public interests, and at the same time to encourage the prospector and miner in order that the mineral resources may be made valuable by development.

COPIES OF THE REGULATIONS MAY BE OBTAINED UPON APPLICATION TO THE DEPARTMENT OF THE INTERIOR.

A. M. BURGESS,

Deputy Minister of the Interior.

SEND FOR SAMPLES AND PRICES FOR

Asbestos Bags, Phosphate Bags, Ore Bags, &c.,

SPECIAL SIZES MADE TO ORDER.

DOUBLE SEWN.

DICK, RIDOUT & CO.,

PROPRIETORS TORONTO BAG WORKS,

Office and Warehouse: 11-13 Front St. East. Factory: 14, 16, 18, 20, 22 Bay St.

ESTABLISHED 1887.

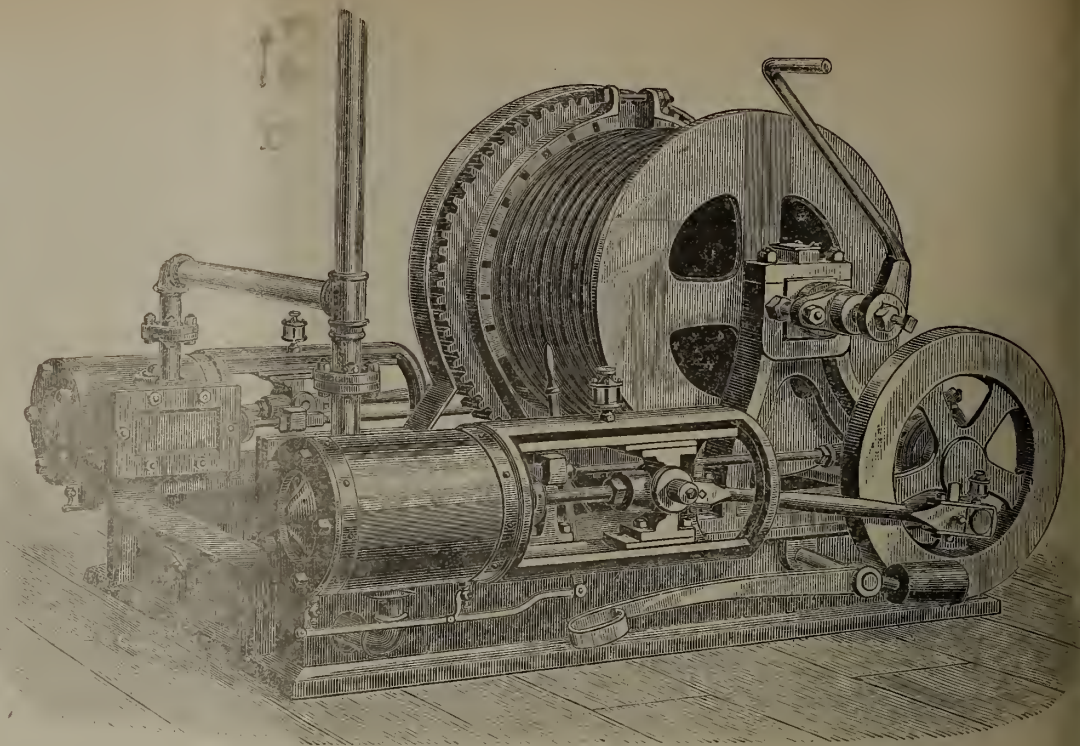
TORONTO.

JOHN DOTY ENGINE CO.

Toronto, Ont.

MANUFACTURERS OF

Mining & General
Machinery.



HOISTING ENGINES

—: FOR :—

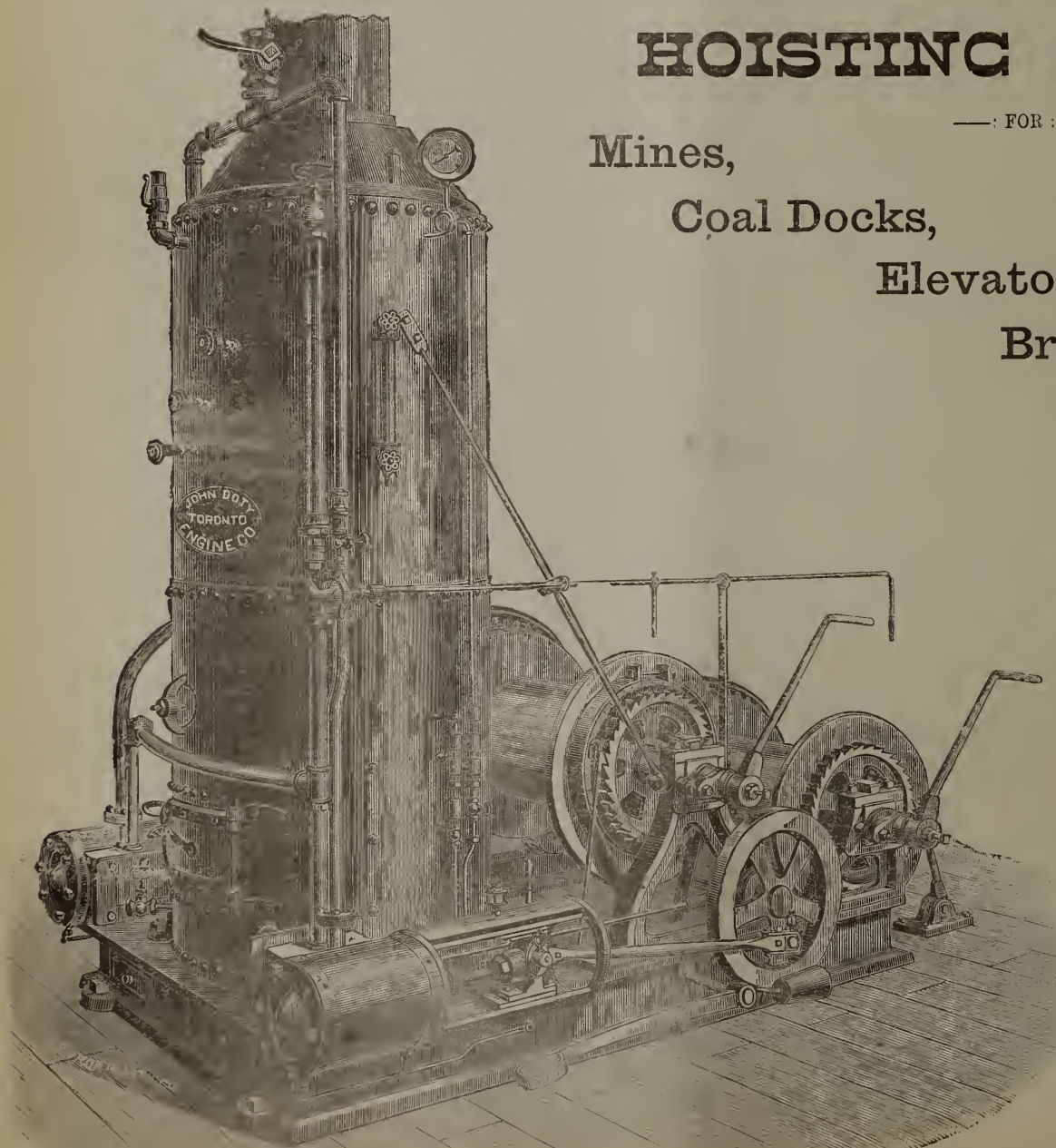
Mines,

Coal Docks,

Elevators,

Bridge Builders,

Contractors, &c.



CORLISS ENGINES

Tug & Steam Yacht Engines,
Mill Engines.

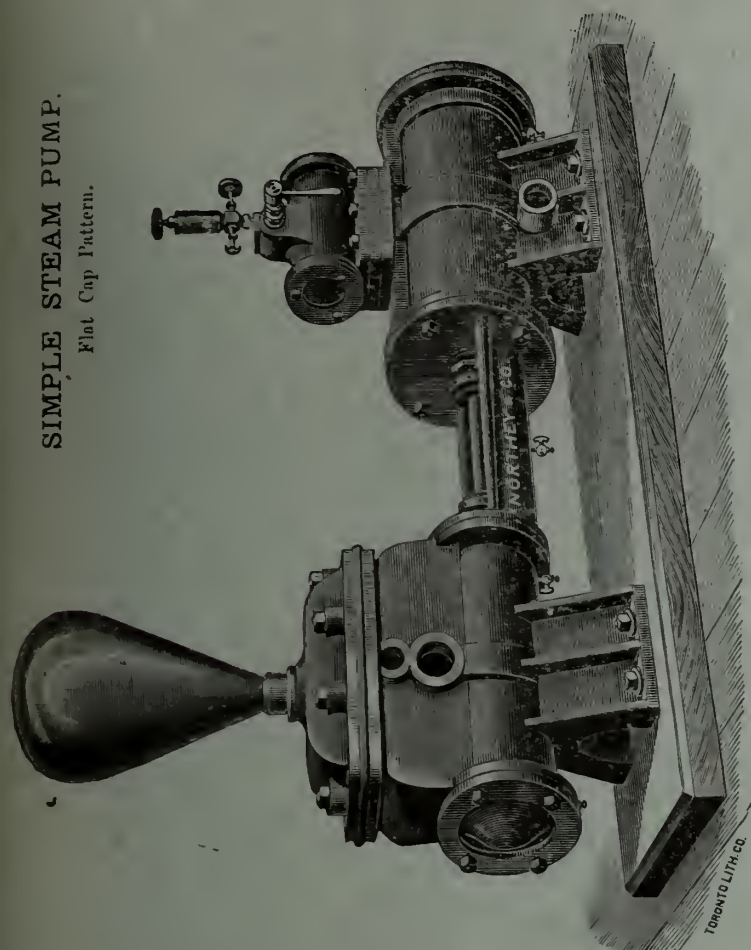
Shafting & Mill
Gearing.

All Descriptions of Boiler
and Tank Work.

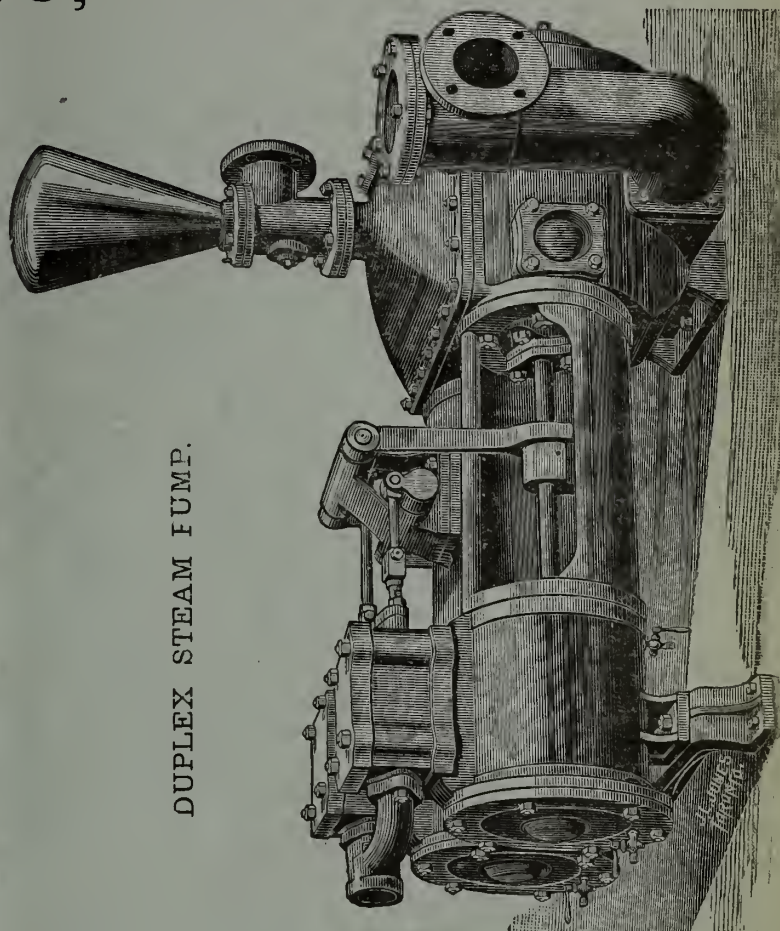
Send for Estimates and
Catalogues.

Northey & Co's Steam Pump Works, TORONTO, ONT.

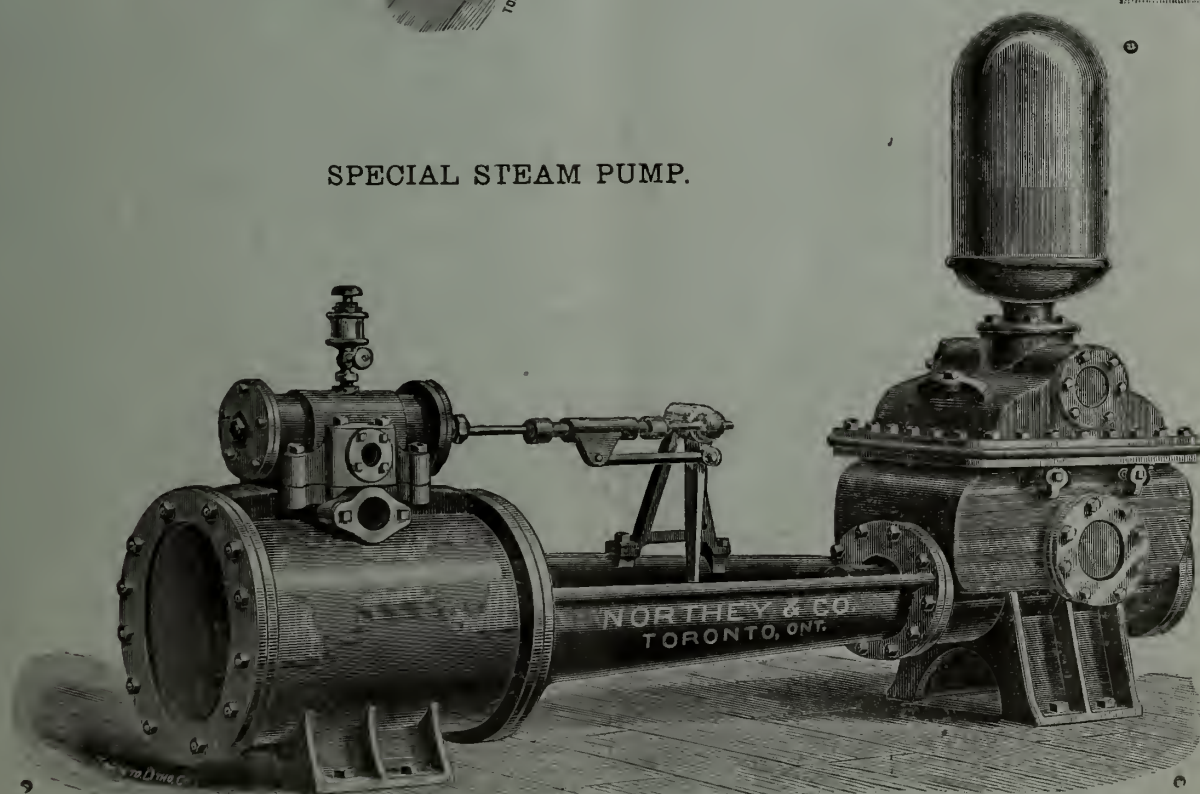
SIMPLE STEAM PUMP.
Flat Cap Pattern.



DUPLEX STEAM PUMP.



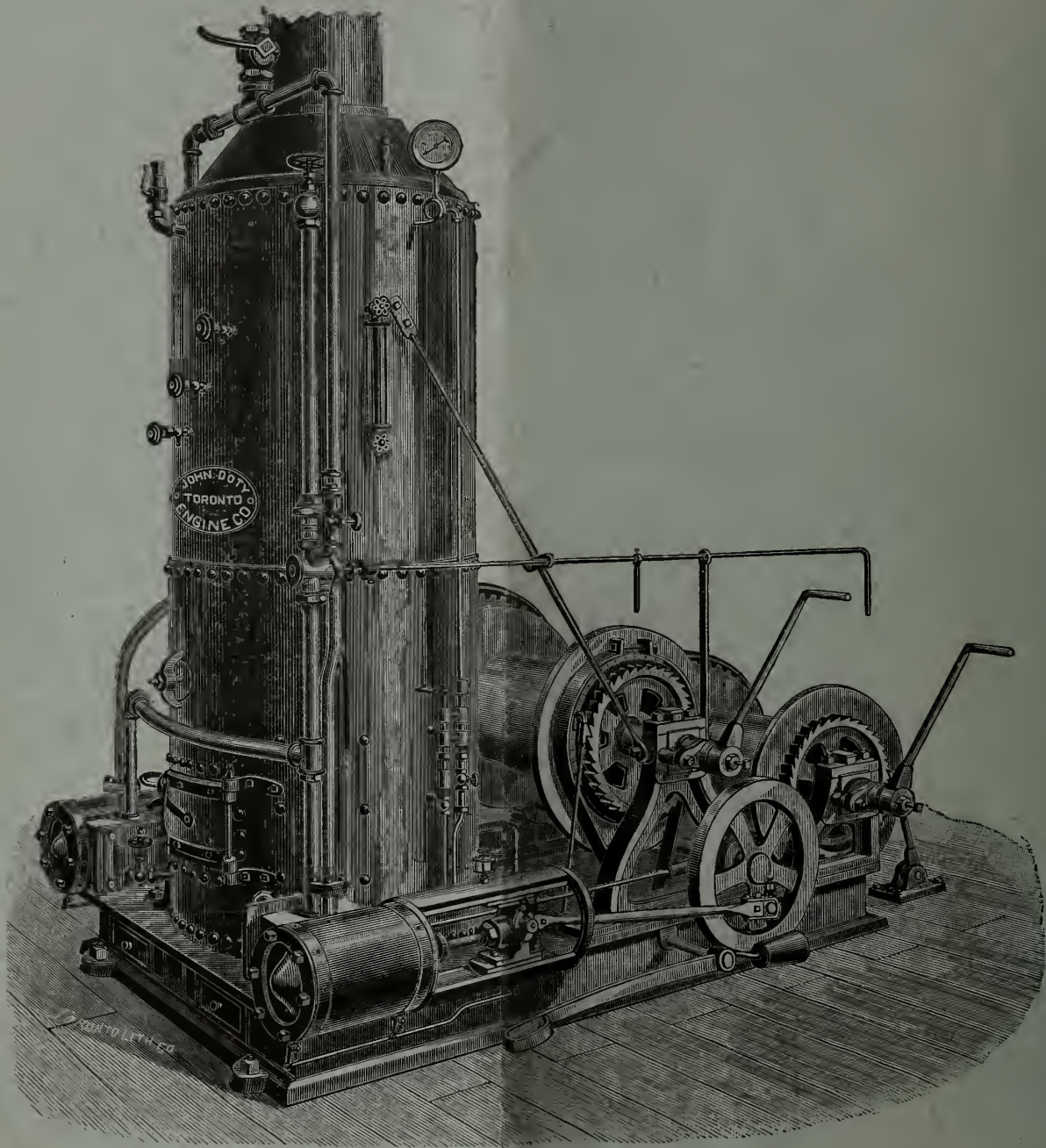
SPECIAL STEAM PUMP.



Steam Pumps of the best and latest designs for mining purposes, Boiler Feeding, Fire Protection, and General Water Supply, etc.

NORTHEY & CO.,
Mechanical  Hydraulic Engineers, Toronto, Ont.
WORKS—COR. FRONT AND PARLIAMENT STS.

A. R. WILLIAMS,
SOHO MACHINE WORKS,
TORONTO, ONTARIO.
MANUFACTURER AND DEALER IN
MACHINERY AND SUPPLIES.



Duplex Steam Pumps, all sizes. Every Pump Guaranteed.
VERY LOW PRICES.

Portable Engines, Hoisting Engines, Stationary Engines, Iron
and Wood Working Machinery, Ventilating Fans, Saw Mill
and Shingle Mill Machinery. Full lines of Machinery and
Supplies. Send for Catalogue.

MINING REVIEW

Canadian

Established 1882

Vol. VIII.—No. 7.

1889.—OTTAWA, JULY—1889.

Vol. VIII.—No. 7.

1889 CATALOGUE OF 200 PAGES, 1889

ROCK DRILLING AND AIR COMPRESSING,

This Catalogue is one of unusual interest and value.—*R.R. Gazette*.
Should be in the hands of every engineer and Contractor.—*Eng. and Min. Journal*.
Supplies a long felt want.—*Manufacturers Record*.
This is a thoroughly good publication.—*Engineering News*.
A valuable addition to the literature on the subject.—*Eng and B.Tg Record*.
The matter is readily available.—*Tradesman*.
A Complete Work.—*Colliery Engineer*.
Handy for reference.—*Min. and Sc. Press*.
The Useful Information will be specially valuable.—*Eng. and B.Tg. Record*.
A really a hand book.—*Am. Manufacturer*.

RAND DRILL CO.,

23 PARK PLACE, NEW YORK.

Hamilton Powder

COMPANY.

Manufacture Mining, Blasting, Military
and Sporting

Gunpowder,

DYNAMITE, DAULIN, and the new

ECLIPSE MINING POWDER

DOMINION AGENTS FOR

Safety Fuse, Electric Blasting
Apparatus, &c.

OFFICE

103 ST. FRANCOIS XAVIER STREET
MONTREAL.

BRANCH OFFICES & MAGAZINES
at all chief distributing points
in Canada.

CANADA ATLANTIC RAILWAY.

THE SHORTEST PASSENGER ROUTE
BETWEEN

Ottawa and Montreal,
AND ALL POINTS EAST & SOUTH.

The only road in Canada running trains lighted
with electricity and heated by steam from the
engine. Luxurious Buffet Pullman Palace Cars
on all trains between Ottawa and Montreal. Only
line running through Sleeping Cars between

Ottawa, Boston and New York

And all New England and New York points.

Baggage checked to all points and passed by Customs in transit.

During season of navigation close connections
are made with Richelieu and Ontario Navigation
Company's Steamers at Coteau Landing, shooting
the St. Lawrence Rapids.

For Tickets, Time Tables and information apply
to nearest agent, or to

S. EBBS, City Passenger Agent,
24 Sparks St., OTTAWA.

GEO. H. PHILLIPS, Gen. Agent,
VALLEYFIELD.

A. E. CAIRNS, General Agent,
136 St. James St., MONTREAL.

Or at 260 Washington St., Boston, and
317 Broadway, New York.

PERCY R. TODD,
General Passenger Agent.

E. J. CHAMBERLAN,
General Manager,
General Offices, Ottawa.

THE CANADIAN RUBBER CO. OF MONTREAL.

A. ALLAN, Pres. • J. O. GRAVEL, Secy.-Treas. F. SCHOLES, M'g. Dir.

Manufacturers of

SUPERIOR QUALITY
RUBBER GOODS.

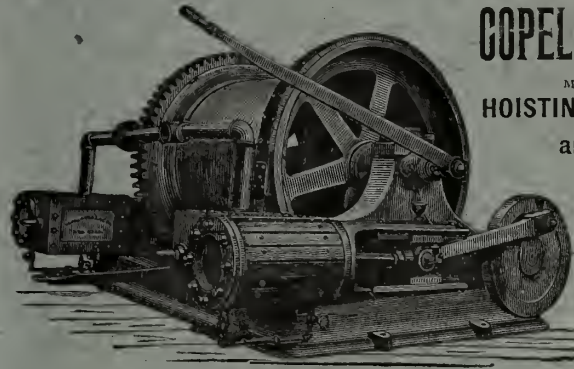
Our Rubber Belting is Un-
equalled in America.

Rubber Packings of all kinds.
Rubber Engine, Hydrant, Suction,
Steam, Brewers' and Fire Hose.
Moulded Goods of every description.

J. H. WALKER, Manager.



Western Branch cor. Front and Yonge Sts.,
TORONTO.



COPELAND & BACON

MANUFACTURERS OF
HOISTING ENGINES,
and MINING PLANTS.

85 Liberty St.

NEW YORK.

Send for Catalogue.

MILLER BROS. & MITCHELL

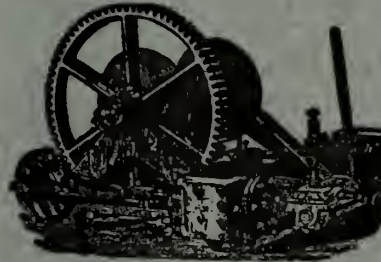
MANUFACTURERS OF

Steam Rock Drills

AND

HOISTING ENGINES,
Mining & Contractors' Plant
&c., &c.

110 TO 120 KING STREET, MONTREAL, QUE.



THE

BELL TELEPHONE CO.

OF CANADA.

ANDREW ROBERTSON, - - - PRESIDENT
C. F. SISE, - - - VICE-PRESIDENT
C. P. SCLATER, - - - SECRETARY-TREASURER

HEAD OFFICE, - MONTREAL.

H. C. BAKER, Manager Ontario Department,
HAMILTON.

This Company will sell its instruments at prices
ranging from \$10 to \$25 per set. These instru-
ments are under the protection of the Company's
patents, and purchasers are therefore entirely free
from risk of litigation.

This Company will arrange to connect places
not having telegraphic facilities with the nearest
telegraph office, or it will build private lines for
firms or individuals, connecting their places of
business or residences. It is also prepared to
manufacture all kinds of electrical apparatus.

Full particulars can be obtained the at Com-
pany's offices as above, or at St. John, N.B., Hal-
ifax, N.S., Winnipeg, Man., Victoria, B.C.

REMINGTON STANDARD TYPEWRITER



MISS M. E. ORR.

Miss Orr, Championship
of the world and Gold Medal
at Toronto, 13th August,
1888.

GEORGE BENGOUGH,

GENERAL AGENT,

36 King Street, TORONTO.

ALEX. FLECK JUN.,

Manufacturer of every Description of

Mill Machinery

Water Wheels, Steam Engines,
Boilers, Derricks, Steam
Pumps and Mining
Machinery.

Brass and Iron Casting of every
Description.

VULCAN IRON WORKS, WELLINGTON ST.
OTTAWA.

DYNAMO ELECTRIC

MACHINES and LAMPS



THE
BALL ELECTRIC LIGHT CO. LD.
MANUFACTURERS OF

ELECTRIC LIGHTING APPARATUS

57, ADELAIDE ST. W.

TORONTO

ONT.

ARC and INCANDESCENT

FOR MINING PURPOSES

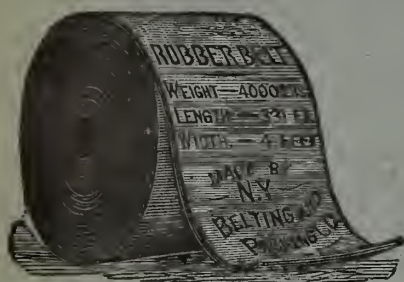
New York Belting & Packing Co.

15 PARK ROW, NEW YORK

JOHN H. CHEEVER, Treasurer.

J. D. CHEEVER, Dep'y Treasurer.

Oldest and largest Manufacturers in the United States of



RUBBER BELTING.

CIRCULAR WOVEN SEAMLESS, ANTI-SEPTIC RUBBER LINED

"CABLE" HOSE and TEST HOSE

For the use of Steam Engines, Force Pumps, Rolling Mills, Iron Works, Factories, etc. Woven in a superior manner to insure wear, compactness and durability.



Emery Vulcanite Wheel.

SOLID VULCANITE
EMERY WHEELS

(Large Wheels made on iron centers)

Cuts Cooler and Freer than any other other wheel in the market.

W. D. ALLEN & CO.,
151 Lake St., Chicago.

European Branch: Pickhuben, 5, Hamburg (Freihafengebeit), Germany.

H. D. EDWARDS & CO.,
Detroit.

**VULCANIZED
RUBBER FABRICS**

FOR MECHANICAL PURPOSES.

**EXTRA RUBBER BELTING
AND HOSE**

FOR MINING PURPOSES.



"TEST HOSE."

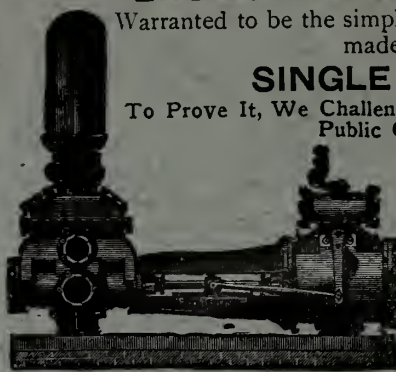
The M. T. DAVIDSON

IMPROVED MINING PUMP.

Warranted to be the simplest and most efficient Steam Pump made, whether it be

SINGLE OR DUPLEX.

To Prove It, We Challenge All Makers of Steam Pumps to a Public Competitive Test.



COMPOUND PUMPING ENGINES,

Obtaining a higher duty than any direct-acting pump made.

MANUFACTURED BY THE

**Davidson Steam Pump
COMPANY.**

New York Office, - - - 77 Liberty Street.

**ROOT'S
SPIRAL RIVETED PIPE**

FOR

Hydraulic Mining,

Water Works

Ranch and Railroad

Water Supplies.



From 2 to 24 inches in diameter and 1 to 25 in length. Manufactured with fittings to suit, capable of withstanding any desired pressure.

ABENDROTH & ROOT MFG. CO.

28 Cliff Street, New York.

Chicago Branch, - - SMITH & KNAPP, 62 South Canal Street

LIDGERWOOD MANUF'G CO.

96 LIBERTY ST, NEW YORK,

34 & 36 WEST MONROE ST. CHICAGO, 197 TO 203 CONGRESS ST. BOSTON,

Largest Manufacturers in the United States of Hoisting Machinery of Every Description for Mines, Tunnel Work, Contractors, and General Hoisting Purposes.

IMPROVED HOISTING ENGINES

FOR MINING PURPOSES A SPECIALTY.

Over 5,000 Engines in Use!

300 Styles

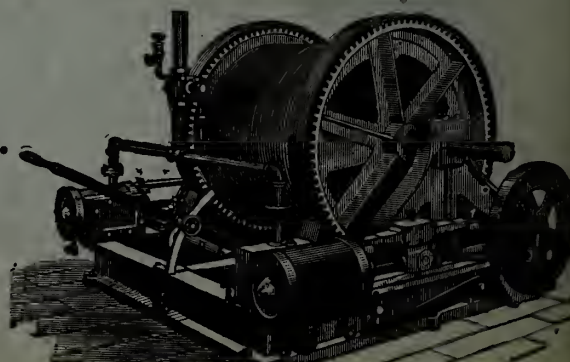
and Sizes.

Send for

CATALOGUE.



FRICION DRUM PORTABLE HOISTING ENGINE.

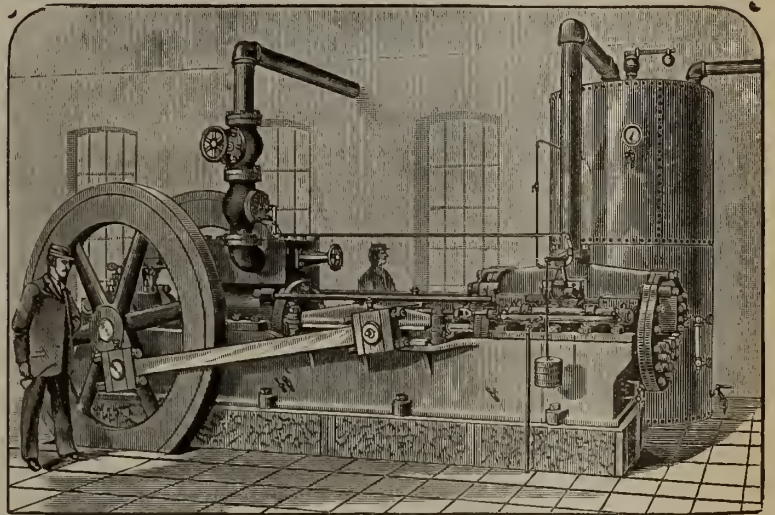


Double Cylinder Reversible Mine Engine.

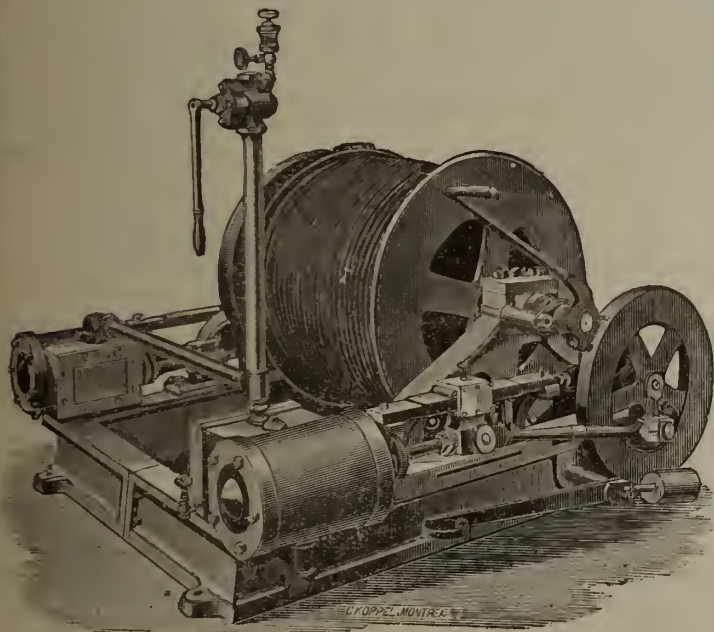


INGERSOLL
ROCK DRILL COMP'Y
OF CANADA
MANUFACTURERS OF

Rock Drills,
Air Compressors,
Steam & Horse Power Hoists,
BOILERS,
—AND—
GENERAL MINING
—AND—
Quarrying Machinery
—AND—
Contractors' Plant.



— ALSO —



Drill Steel, Wire Rope,
Derrick Castings,
Steam & Air Hose & Couplings,
Iron Piping, Fittings,
—AND—
ALL KINDS OF SUPPLIES
—FOR—
Miners & Contractors' Work.

For Estimates, Catalogues and information address

Ingersoll Rock Drill Co. of Canada

204 St. James St., or P.O. Box 1942, Montreal.

F. G. BECKETT ENGINE CO.

HAMILTON, ONT.



Having had many years practical experience in the manufacture of

MINING MACHINERY

IS NOW PREPARED TO CONTRACT FOR

Stamp Mill Machinery,
Concentration Mills,
Revolving, Roasting and
Drying Furnaces,
Rock Breakers,
Cornish Rolls for crushing,
Amalgamating Pans and Settlers,
Concentrators and
Revolving Screens,
Smelting Furnaces, Retorts.

HOISTING ENGINES,

EITHER GEARED OR DIRECT ACTION.

Cornish Pumping Machinery,
Iron Ore Cars, Safety Cages, &c.,
Rock Drills and Air Compressors.

STEAM ENGINES AND BOILERS.

Marine Engines and Steam Yachts

Francis D. Taylor
MINING ENGINEER,
ROCKVILLE, - ONTARIO

SPECIALTY. — The Mining of Iron Ores, and the Manufacture of Iron and Steel. Mr. T. has had for many years the management of large mining enterprises in England and the U. S. A.

CAMERON STEAM PUMP
SIMPLE, RELIABLE, COMPACT, DURABLE.
NO OUTSIDE VALVE GEAR.
THE A. S. CAMERON STEAM PUMP WORKS.
ADAPTED FOR ALL PURPOSES.
FOOT OF EAST 23rd STREET, NEW YORK.



DOMINION ASSAY OFFICE,
Gold and Silver Ores and Bullion
ASSAYED, REFINED AND PURCHASED.
Mining Properties bought, sold and examined. Fifteen years experience in Australia, New Zealand and California.
44 VICTORIA STREET, - - TORONTO.
H. ANN, PROP.

WM. HAMILTON MERRITT, F.C.S.
Associate Royal School of Mines, &c.,
Mining Engineer and Metallurgist,
Will report on Mines and Mineral Properties.
ADDRESS:
15 TORONTO ST., TORONTO, ONT.

J. T. DONALD, M.A.,
Analytical Chemist and Assayer,
124 St. JAMES St. - MONTREAL.
Analyses and Assays of every description. Manufacturing processes practically tested. Laboratory instruction in Chemistry, Assaying and Mineralogy. Terms on application.

TAYLOR McVEITY,
Barrister, Solicitor, &c.,
Supreme Court and Departmental Agent,
SCOTTISH ONTARIO CHAMBERS, OTTAWA.

THE DOMINION
Leather Board Co.
MONTREAL,

—MANUFACTURERS OF—
Leather Board & Stiffeners
ALSO OF
ASBESTOS MILL BOARD,
STEAM PACKING, and
FRICTION PULLEY BOARD.

Samples and prices furnished upon application.
Please mention this paper.



ONTARIO
Mining Regulations.

The following summary of the principal provisions of the General Mining Act of the Province of Ontario is published for the information of those interested in mining matters in the Algoma District, and that part of the Nipissing District north of the Mattawan River, Lake Nipissing and French River.

Any person or persons may explore for mines or minerals on any Crown Lands surveyed or unsurveyed, not marked or staked out or occupied.

The price of all lands sold as mining locations or as lots in surveyed townships is two dollars per acre cash, the pine timber being reserved to the Crown. Patentees or those claiming under them may cut and use such trees as may be necessary for building, fencing or fuel, or for any other purpose essential to the working of mines.

Mining locations in unsurveyed territory shall be rectangular in shape, and the bearings of the outlines thereof shall be due north and south, and due east and west astronomically, and such locations shall be one of the following dimensions, viz: eighty chains in length by forty chains in width, containing 320 acres, or forty chains square, containing 160 acres, or forty chains in length by twenty chains in width, containing 80 acres.

All such locations must be surveyed by a Provincial Land Surveyor, and be connected with some known point or boundary at the cost of the applicant, who must file with application surveyor's plan, field notes and description of location applied for.

In all patents for mining locations a reservation of five per cent. of the acreage is made for roads.

Lands patented under the Mining Act are free from all royalties or duties in respect to any ores or minerals thereon, and no reservation or exception of any mineral is made in the patents.

Lands situated south of the Mattawan River, Lake Nipissing and French River are sold under the Mining Act at one dollar per acre cash.

Affidavits showing no adverse occupation, improvement or claim should accompany applications to purchase.

A. S. HARDY,
Commissioner,
Department of Crown Lands, Toronto.

The Canada Co.

Will issue Licences to Prospect or to work Minerals on any of their Mining Lands and Mineral Reservations,
Covering nearly a

Quarter of a Million Acres

In Eastern Ontario, and principally within the belts containing

Iron, Phosphate, Gold, Galena, Plumbago, Mica, Marbles, Building Stone, and other valuable Minerals.

For list of lands and terms apply to the company's Mining Inspectors,

H. T. STRICKLAND,
Peterborough, Ont.,

For lands in the County of Hastings and Westward, and to

ANDREW BELL, P.L.S.,
Almonte, Ont.,

For lands East of the County of Hastings.

TO MINERS AND OTHERS.

Bannerman & Powers,

VULCAN BOILER WORKS,

428 and 340 Wellington St., Ottawa.

MANUFACTURERS OF

IRON AND STEEL BOILERS

OF EVERY DESCRIPTION.

Trucks, Girders, Iron Roofing, Bank Vaults, Smoke Stacks

—AND ALL KINDS OF—

SHEET IRON WORK.

Repairs Neatly and Promptly Executed

FENWICK & SCLATER,

Manufacturers of Asbestos, Fire Hose, Files and Cotton Waste, Miners of Asbestos and Soapstone,

ASBESTOS

Cotton, Leather and Rubber Belting,

42, 44 & 46 Foundling Street, Montreal.

H. R. IVES & CO.,
Hardware Manufacturers and Founders,
QUEEN ST., MONTREAL.

STOVES. TRADE MARK "Buffalo" — IRON BEDSTEADS FOR MINERS' USE.	PORTABLE FORGES. — BLACKSMITH'S DRILLS.	MONTREAL SMELTING CO'S BABBIT METAL.	CASTINGS Of every description to order. — SOIL PIPE.
---	---	---	---

PORTABLE ENGINES AND SAW-MILLS

Of all capacities—from 3000 feet of lumber and up per day.

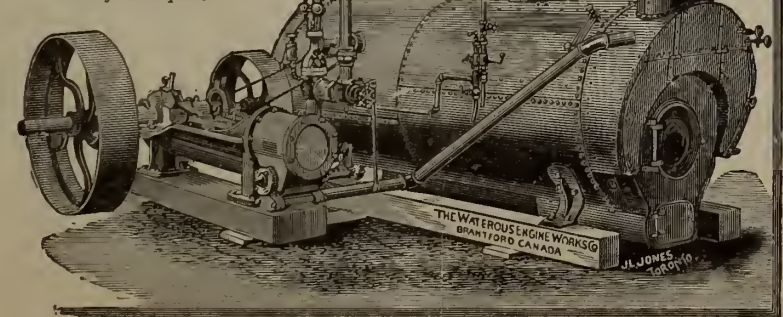
Saw-Mills.
Shingle-Mills.
Lath-Mills.
Chopping-Mills.

ENGINES
OF ALL SIZES.

BOILERS

of all capacities,
IRON OR STEEL,
ALL STYLES.

Send for Circulars, stating what you require.



Waterous Engine Works Co. Brantford, Canada.
St. Paul, Minn., U.S.A.

JOHN E. HARDMAN, S.B.
MINING ENGINEER,
OLDHAM, NOVA SCOTIA.

Can be consulted on all matters pertaining to the profession.
 The development and management of Gold Properties a specialty.

WILSON & GREEN,
Commission Merchants,
 PHOSPHATE SHIPPERS.
AGENTS HIGH ROCK MINE.

30 St. François Xavier St., - MONTREAL.

EDMUND SPARGO,
 Consulting and Mining Engineer, 3 Cable Street,
 Liverpool.

Owners of or Investors in Metalliferous Mines, Slate, Granite, and other Stone Quarries, Brick, Terra Cotta, Fire and other Clays and Mineral Estates in general, requiring reliable and sound advice either in the Purchase or Disposal thereof, should consult E.S., who has executed important professional Commissions in Germany, Austria, Hungary, France, Belgium, Spain, Portugal, Sweden, Norway, and in the various Mining Districts throughout Great Britain and Ireland. Telegraphic Address: "Spargo," Liverpool. Bankers, National Provincial Bank of England, Liverpool.

THOMAS HEYS,
 Analytical and Consulting Chemist and Assayer.

References are kindly permitted by the following:
 Messrs. Gooderham & Worts, Toronto, Limited; Messrs. P. R. Lamb & Co.; John Livingston, Esq., Dominion Bolt Co.
 Assay and Analytical Laboratory }
 16 King St. West, opposite the Rossin House, } **TORONTO.**

J. LAINSON WILLS,
 F. C. S., ETC.

Late Manager Canadian Phosphate Co. (Lim.),
 Reports upon Mines and Mining properties.
 Advice given on Chemical and Metallurgical processes.
SPECIALTIES: PHOSPHATE AND GOLD.
 TELEGRAPHIC OR POSTAL ADDRESS:
WILLS, BUCKINGHAM, P.Q.

Irwin, Hopper & Co.
MINERS AND SHIPPERS OF MINERALS,

30 St. François Xavier Street,
MONTREAL, CAN.

Asbestos, crude and manufactured. Phosphate, Mica, Plumbago, Soapstone, &c.

JOHN D. FROSSARD, B.S., M.E.
 MINING ENGINEER & GEOLOGIST,

30 St. François Xavier St., - - Montreal.
 Specialty—Phosphate Lands.

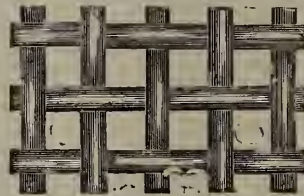
JAMES HOPE & CO.,
BOOKSELLERS,
 Stationers, Bookbinders and Printers,
OTTAWA.

SPEIGHT & VanNOSTRAND,
Dominion and Provincial Land Surveyors,
Draughtsmen, Valuers, &c.
 OFFICE: ROOM "J," FIRST FLOOR, TORONTO ARCADE,
 YONGE ST., TORONTO.
 Surveys, Plans, Descriptions of Properties, etc., promptly executed.
 Timber Limits and Mining Claims Located.

MILLAR & CO.
 General Merchants & Shipping Agents
 ATLANTIC CHAMBERS,
 209 COMMISSIONER ST., - MONTREAL
 Cable address, "Hoyer, Montreal." P.O. Box 1095.
 AGENT FOR The Canadian Phosphate Co., Ltd., of London, Eng.,
 The Montreal Union Abattoir Co., of Montreal, Can.
 English Correspondents Messrs. Couper, Millan & Co., London, England.



For Mining Hoisting Derricks, etc.



Stro g Wire Cloth and Screens
 For Mining, etc., manufactured by
B. Greening & Co.
 HAMILTON, ONT.

NATIONAL COLONIZATION
Lottery!
 UNDER THE PATRONAGE OF
THE REV. FATHER LABELLE.

Established in 1884 under the Act of Quebec, 31 Vict.,
 Chap. 36, for the benefit of the Diocesan Societies
 of Colonization of the Province of Quebec.

CLASS D.
 DRAWINGS ON THIRD WEDNESDAY IN EVERY
 MONTH AT 2 P.M.

Prizes value \$50,000
 Capital Prize: 1 Real Estate worth \$5,000.

LIST OF PRIZES.

1 Real Estate worth	\$5,000	\$5,000
1 Real Estate worth	2,000	2,000
1 Real Estate worth	1,000	1,000
4 Real Estates	500	2,000
10 Real Estates	300	3,000
30 Furniture Sets	200	6,000
60 Furniture Sets	100	6,000
200 Gold Watches	50	10,000
1000 Silver Watches	10	10,000
1000 Toilet Sets	5	5,000

2307 Prizes worth \$50,000
Tickets, \$1.00!
 Offers are made to all winners to pay their prizes cash,
 less a commission of 10 p. c. Winners' names not published
 unless specially authorized.
 S. E. LEFEBVRE, Secretary
 Office: 19 St. James St., Montreal, Can.

W. Blakemore, F.G.S., M.E.,
 Member of I. & S.I. | A. Montgomery Evans, M.E.
 of Canada & U.S.
BLAKEMORE & EVANS,
MINING & CIVIL ENGINEERS
 Exchange Buildings, Cardiff, S.W.

LONDON OFFICE:
 Robert H. Jones, 82 Queen St., Cheapside, London, E.C.
 Reports, Estimates, and Valuations made on Iron and Steel Works,
 Blast Furnaces, and all classes of Mining Properties.
CANADIAN BUSINESS PROMPTLY ATTENDED TO.

To Prevent Boiler Explosions
 And other accidents to steam boilers, and to secure
 economy in working, insure with
THE BOILER INSPECTION
AND INSURANCE COMPANY OF CANADA.

Sir Alex. Campbell, K.C.M.G., | John L. Blaikie, Esq.
 President. Vice-Pres.
HEAD OFFICE: - - - - - TORONTO
 G. C. ROBB, Chief Engineer.
 A. FRASER, Sec'y-Treas.

ORFORD COPPER CO.,
COPPER SMELTERS.
 Works at Constable's Hook, N.J., opposite new Brighton,
 Staten Island. Copper Ore, Mattes, or Bullion
 purchased. Advances made on consignments for refining
 and sale. Specialty made of Silver-Bearing
 Ores and Mattes.
 SELL
INGOT AND CAKE COPPER.
 President, **ROBERT M. THOMPSON,**
 Treasurer, **G. A. LAND.**
 Office, 37 to 39 Wall Street, New York.

Robin & Sadler,
 MANUFACTURERS OF
LEATHER BELTING.
 TRY OUR
Waterproof Belting,
 Just the thing for Mining Machinery.

MONTREAL, 2518, 2520, 2522 Notre Dame St.
TORONTO, 129 Bay Street.

Diamonds, Jewelry, Watches & Silverware
AT ROSENTHAL'S
Goldsmith's Hall, 87 Sparks St.
OTTAWA.

T. D. LEDYARD,
DEALER IN MINERAL LANDS
 4 ONTARIO CHAMBERS, TORONTO.
 Will buy undeveloped iron ore and other mineral properties.
 WANTED. — Deposits of Magnetic Iron Ore, Red Hematite,
 Brown Hematite, Galena, Iron and Copper Pyrites, Mica, Soap-
 stone, Marble, Gypsum, Baryta. Samples can be sent by Sample
 Post for 1 cent for 4 oz. or up to 24 oz. in weight.
 Information regarding mines cheerfully given. Correspondence
 solicited. Crown Land Business attended to.

CHEMICAL APPARATUS! OF EVERY DESCRIPTION.



Glass, Porcelain, Stoneware, Platinum Crucibles of every sort, Analytical Scales and Weights, Fine Chemicals and Reagents, including Volumetric Solutions. Every requisite for Analysis or Experiment. For Sale by

LYMAN, SONS & CO.,

384 St. Paul St., Montreal.

Illustrated Catalogue mailed on receipt of 10c. or Business Card.

Boiler For Sale.

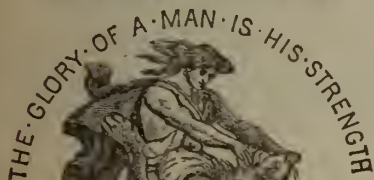
A N EIGHTY H.P. TUBULAR STEEL BOILER made by W. C. White, Montreal, 15 ft. x 5 ft. 4 in. — eighty 3 1/2 in. tubes; smoke stack 45 ft. long; guyards and guys. Very little used. Equal to new. Price on cars, \$600. Address

P. O. Box 6,
MONTREAL.

IMPROVE YOUR HEALTH

And INCREASE your MUSCULAR DEVELOPMENT
By taking REGULARLY

JOHNSTON'S



FLUID BEEF.

The most strength-giving food for
YOUNG or OLD or for the SICK or HEALTHY.

Victor Electric Fuses.

Superior to all others for Exploding any make of Dynamite, High Explosives, or Gelatine Powder. Each Fuse is tested and warranted extra strong and waterproof. Low grades of Dynamite Powder will do ten per cent. more execution if detonated with Victor Electric Fuses.

VICTOR BLASTING MACHINES.

Latest improvements, made in three sizes, easy to operate, strong and durable. No expensive repairs, low in price, will fire any make of Electric Fuses.

MANUFACTURED ONLY BY

JAMES MACBETH & CO.,

128 Maiden Lane, N.Y., U.S.A.

Send for Catalogue.

FOR SALE.

A COAL MINE IN CAPE BRETON,

Area, 970 acres, underlain by 6 or 7 beds of the best Coal in Nova Scotia. The property is estimated to contain from 50 to 60 million tons of Coal. No Coal Mine can be more easily or cheaply operated. The angle of dip is 6 degrees, and the rock stratification is remarkably even and without fault or break.

Apply to

ALEXANDER CAMPBELL,
Annapolis Royal, N.S.

EDMUND C. SHOREY, M.A.,

Analytical Chemist,

FOOT OF PRINCESS STREET } - - KINGSTON.

MINERALS OF ALL KINDS assayed at reasonable rates.
Analyses of Milk, Water, &c.

PHOSPHATES A SPECIALTY.

D. McEWEN & SON,

Machine, Engine & Boiler Works

(Established January, 1868)

Compound and Yacht Engines a Specialty.
Estimates for Steamboats complete.

MINING REPAIRS CONSTANTLY ON HAND.

WORKS AND OFFICE:

54 to 60 Queen Street, Kingston, Ont.

Coal at Edmonton. — At Edmonton, a coal seam four feet thick crops out on the south bank of the Saskatchewan, forty feet above the water. A small quantity has been mined from it; but lately Mr. Donald Ross has run a drift into the north bank through a mass of quartzite pebbles slidden from above. The seam consists of three feet of good workable coal, overlain by about one foot of dark clay shale, which is again overlain by a considerable thickness of impure coal. It has not been found advisable to work this upper part of the seam, but it forms a very good roof for the drifts and rooms. The coal is being used in Edmonton at different forges and throughout the town generally. It burns well, both in stoves and in open grates, making a clear hot fire, and when stored under a roof can be kept for a long time in a perfectly serviceable condition; a quantity of this coal which had been lying in a shed for a year was still in lumps of fair size, and when burned made an excellent fire.

The Ditton Gold Field. All the reports bearing upon the gold of Quebec refer only to the Chaudière valley. Other areas are known which promise quite as good returns to capital well applied; among them may be mentioned the upper waters of the Salmon River, more particularly in the Township of Ditton. That attention has not been directed to this locality is in large measure due to the fact that what is regarded as the most promising field for work is entirely in private hands, and no royalty being in consequence paid to the Government, no official returns are available as to the amount of the precious metal obtained. Alluvial gold has, however, been found there and worked for many years. The place where operations have been more particularly carried on is on the Little Ditton streams, on Lots 23 and 24 R.W. Ditton. Nuggets ranging in value from \$50 to \$150 are reported as having been found. The rocks are black, wrinkled, and sometimes pyritous slates and grey sandstones, in character similar to much of those on the upper part of the Chaudière, and also to those of the gold series of Nova Scotia. Veins of all sizes, up to several feet, traverse the slates, generally with the bedding, though occasionally transverse to it. No attempt has yet been made, in so far as could be ascertained, to test the value of these veins, though that some of those on the Little Ditton are auriferous is proved by the finding of ragged gold in quartz in close proximity and below them in the bed of the river.

ALEX. RANKIN,

20 Toronto Street, Toronto Ont.

Agent for sale of Mines and Mineral Lands.

CORRESPONDENCE SOLICITED.

Agents in England and New York.

E. H. SARGENT & CO.,

IMPORTERS AND DEALERS IN

ASSAYER'S MATERIALS,

Chemicals and Laboratory Supplies.

125 State Street,

CHICAGO.

HARRIS & CAMPBELL

Latest Designs in Drawingroom, Diningroom
and Bedroom

FURNITURE

With improved Steam Machinery our facilities for manufacturing Cabinet Goods are complete. Our upholstery Department is well stocked with latest imported patterns.

Corner **QUEEN & O'CONNOR Sts.**
OTTAWA.

THIS YEAR'S

MYRTLE

CUT AND PLUG

Smoking Tobacco

FINER THAN EVER.

SEE

T & B

In Bronze on Each Plug and Package.

THE DOMINION

SAFETY BOILER CO.

MANUFACTURERS OF

The "Field-Stirling" Patent High
Pressure Boiler,

The Safest and Cheapest Steam-Generator now in Use.

This Boiler is unusually durable, being made of the best steel and wrought iron exclusively. No cast-iron is employed. It is simple in construction, has a rapid, well-defined circulation, and a large cool mud-drum, where all impurities are collected to be blown off. All parts of the boiler are readily accessible for the closest inspection. It has great excess of strength and is not liable to be strained by unequal expansion. The water space is divided into sections so arranged that NO EXPLOSION IS POSSIBLE.

Some of Our Leading Customers:

The J. A. Converse Mfg. Co. (A. W. Morris & Bro.), Montreal; The Canada Sugar Refining Co., Montreal; The Pillow and Hersey Mfg., Montreal; The Berthier Beet Root Sugar Co., Berthier, Que.; The Imperial Insurance Co., Montreal; The Massey Manufacturing Co., Toronto; The Acadia Coal Co. (Ltd.), Stellarton, N.S.; Canada Paper Co., Windsor Mills, Que.; Royal Electric Co. (Central Station), Montreal; Dodge Wood Split Pulley Co., Toronto, and a repeat order from A. W. Morris & Bro., after five months' experience; Ingersoll Rock Drill Co. of Canada.

We guarantee Dry Steam and Great Economy
of Fuel. Correspondence Solicited.

J. FRASER TORRANCE, M.E.,

P.O. Box 1707, Montreal.

Manager.

If you want

BAGS

FOR PACKING

ASBESTOS, PHOSPHATES, ORES, &c.,
Send to us for Samples and Prices.

Every quality and size in stock.

Specially strong sewing for heavy materials.

Lowest prices compatible with good work.

We now supply most of the Mining Companies, and those who have not bought from us would find it to their advantage to do so.

THE CANADA JUTE COMPANY (LTD.)

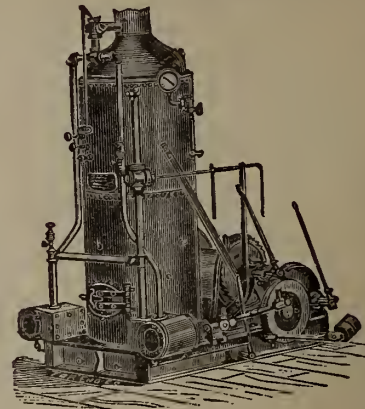
17, 19 & 21 ST. MARTIN STREET,

Established 1882.

MONTREAL.

M. BEATTY & SONS,

WELLAND, ONT.



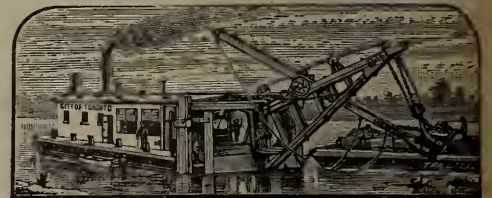
HOISTING
ENGINES

ENGINES
FOR
Mines
AND
Inclines

Horse-Power Hoisters,

Stone Derrick Irons,

Centrifugal Pumps.



DREDGES,

DERRICKS,

STEAM SHOVELS,

And other Contractors' Plant.

AMALGAMATING MACHINERY.

Stamp Mills for Wet or Dry Crushing. Huntington Centrifugal Quartz Mill. Drying Cylinders. Amalgamating Pans. Settlers, Agitators and Concentrators. Retorts, Bullion and Ingot Moulds, Conveyors, Elevators, Bruckners and Howell's Improved White's Roasting Furnaces, Etc.

CONCENTRATING MACHINERY.

Blake, Dodge and Comet Crushers, Cornish Crushing and Finishing Rolls, Hartz Plunger and Collom Jigs. Frue Vanner & Embrey Concentrators, Evans', Calumet, Collom's and Rittenger's Slime Tables. Trommels, Wire Cloth and Punched Plates. Ore Sample Grinders and Heberle Mills.

FRASER & CHALMERS, MINING * MACHINERY.

Improved Corliss and Slide-Valve Steam Engines,
Boilers--Horizontal, Vertical and Sectional,

IMPROVED STEAM STAMPS.

Holisting Engines, Safety Cages,
Safety Hooks,
Ore Cars, Water and Ore Buckets,
Air Compressors, Rock Drills, Etc.
General Mill and Mining
Supplies, Etc.



Pumping Engines and Cornish
Pumping Machinery,
Improved Water Jacket
Blast Furnaces for Calena and
Copper Ores.
Slag Cars and Pots,
Roots & Baker Pressure Blowers,
Suspended Tramways.

Sectional Machinery for Mule-Back Transportation.

General Offices and Works: FULTON & UNION STS., CHICAGO, ILL.

BRANCH OFFICES: NEW YORK, Room 43, No. 2 Wall St. DENVER, COLO., 1316 Eighteenth St. SALT LAKE CITY, UTAH, 7 West Second South St. LONDON ENGLAND, 23 Bucklersbury, E. C. CHIHUAHUA CITY, MEXICO, No. 11 Calle de Juarez. LIMA, PERU, South America. JOHANNESBURG, TRANSVAAL, South Africa.

ASBESTOS.

THEO. HAMEL,

44 Mountain Hill, Quebec,

SOLE ASBESTOS MANUFACTURER in CANADA

Write for prices and catalogue. Use Asbestos and save your money. Applied on boilers and Steam pipes it will prevent them from rusting and will economize 33% on fuel.

The Canadian Mining Review

CONDUCTED BY . . . B. T. A. BELL

OFFICES:

UNION CHAMBERS, 14 Metcalfe St.

OTTAWA.

Vol. VIII. JULY, 1889. No. 7.

Chemical Contributions to the Geology of Canada.

One of the most important and responsible, while at the same time, perhaps the least known position in the Geological Survey, is that of the Analytical Chemist and Mineralogist. Working as he does, quietly and unobtrusively, in his laboratory, it is on the results of his experiments that many of the conclusions arrived at, and published officially to the world, are based.

Mr. G. C. Hoffman, F.R.S.C., who fills this position, has long ago established his reputation, and is an acknowledged authority on mineralogy. We have before us Part T of the Annual Report of the Geology and Natural History of Canada for 1887, which contains "Chemical contributions from the laboratory of the Survey," a mere glance through which will convey to those who know anything about assays, the labour involved in the preparation of this publication. Mr. Hoffman says that his work, during that year, was "purely of a practical character, having been confined exclusively to the examination of such minerals and specimens as promised to prove of economic importance." He was assisted in his work by Mr. Frank D. Adams, M. A. Sc., who, by the way, has just been appointed a professor in McGill College University, a well merited acknowledgment of his skill, and by Mr. E. B. Kenrick, B.A., as junior assistant, who has also left the Survey for a better position at St. John's College, Winnipeg. Whilst wishing these gentlemen every success in their new spheres, it seems a pity that their services should have been lost to the country, and we are afraid that the spirit of economy, as far as remuneration for valuable services is concerned, may in this case, and in some others, tend to prove the truth of Solomon's words, "There is that withholdeth more than is meet, but it tendeth only to penury."

The principal Assays dealt with by Mr. Hoff-

man were: Lignite from the Saskatchewan river, coal from the Rocky Mountains and the Pacific Coast, iron ore from various parts of the Dominion, precious metals from various quarters, and a variety of specimens of a general character, the assays of which tend to show the value of the deposits from which they were obtained. One very interesting contribution, in addition to the minerals, is an analysis of the water from the Thermal Spring at Banff, and another on water from a mineral spring near Belvedere, Province of Quebec. With regard to mineral waters, it is remarkable how little reliable information there is in print respecting them, and, with the exception of one article, some years ago, from the pen of Dr. Sterry Hunt, on mineral waters, we doubt if there is any Canadian publication confined entirely to this subject. We noticed some two years ago, an article in "Wood's Medical Cyclopaedia," by Dr. B. Small, of this city, on Mineral Springs, which has attracted a good deal of attention, more especially in the United States, where the work is published, though we have seen it referred to in Canada. This article is, we believe, the latest contribution published on this subject.

The analysis of the Banff waters in Mr. Hoffman's report is credited by him to Mr. F. D. Adams, the gentlemen referred to above, and is the most comprehensive in detail yet made. The report does not say where the analysis was made nor what time elapsed between procuring the water and the analysis itself. These are considered by experts to be material points in this relation. Mr. Hoffman states that many more examinations are made during the year than those, the results of which are published, the latter only containing those likely to prove of general interest. The extreme accuracy in the work of assaying is made apparent especially in the report on a specimen of tin ore, reported to have been found in Compton County, P. Q. Mr. Hoffman says: "On two of the fragments were observed what apparently consisted of imperfectly removed labels." With microscopical power and chemical action all possibility of palming off in any case spurious specimens is entirely done away with. We are of opinion that when the time comes, which we hope is not far distant, for the publication of a new "Geology of Canada," similar to that got up by Sir Wm. Logan, it would be a boon to Scientists generally if the various assays made by Mr. Hoffman year by year and published in the Annual Survey Reports, were compiled into one volume. Separated, as they are at present, through so many different reports, it requires considerable search to find out any one particular analysis, and, where all are of so much individual value, a work of this nature, properly indexed, would not only be of value in itself, but would tend, if possible, to make more public Mr. Hoffman's researches, so unobtrusively carried on.

Nitrates v. Phosphates.

The frequently quoted simile referring to the respective merits of nitrates and phosphates, as a plant food, that "the nitrate is like a glass of spirits, the phosphate like a plate of beef," is an exceedingly terse way of putting a generally acknowledged fact that, while the former is a mere stimulant, the application of phosphate adds permanently to the fertility of the soil. The simile, however, might with equal accuracy be continued as follows:—"But a combination of the two is like a substantial dinner."

The application of science to agriculture is of comparatively recent date, but, nevertheless, the progress in agricultural chemistry has wrought, as was to be expected, a corresponding advantage in the art of farming. It was soon ascertained that the artificial barrenness produced by exhaustion yields, under proper conditions, to the touch of science. Certain constituents, it was found, are indispensable for plant growth, and of these the largest quantities were continually being withdrawn. Chief among these constituents are phosphoric acid, nitrate of potash or soda, and ammonia. Most agricultural soils contain sufficient iron, magnesium, calcium, chlorine, sodium, and sulphur to last for ages; but the disproportion between the amount of the three former ingredients required by plants and the amount replaced in the soil by nature is so great that exhaustion of these elements follows as the necessary consequences of continuous cropping.

The application of science to agriculture resulted in nothing more and nothing less than the creation of a new industry, namely, the production of "commercial fertilizers."

The introduction of artificial fertilizers marks, therefore, a new epoch in the history of agriculture. Their general acceptance in common farm practice is equivalent to the introduction of a new force. They have revolutionised the mode of agriculture as thoroughly as steam and electricity have revolutionised transportation and commerce. By their judicious application a barren soil can be changed into one of great productiveness. Therefore the principal functions of a good fertilizer are to supply to the soil the three elements of plant-food usually wanting in poor or exhausted lands, viz., phosphoric acid, ammonia, and nitrate of potash or soda.

The application of scientifically prepared concentrated plant-food to the soil forms a means of estimating the progress which a country is making in the domain of agriculture. The marvellous ease and rapidity with which France paid off the enormous war indemnity of five milliards of francs has justly taken the world by surprise. Yet to a great extent it was due only to the wealth Frenchmen knew how to derive from the land they live on by a generous and intelligent method of farming, and to nothing else can this be ascribed but a practical recognition of the value of artificial manure.

Is it not strange, therefore, in the year 1889, when it has been clearly and repeatedly proved by all the leading scientists of the day, as well as by practical demonstration, that each and all of the three elements enumerated above are requisite and necessary to form the basis of a satisfactory and practical fertilizer, that men of intelligence can be found antagonistically debating the respective merits of phosphoric acid, as represented by the general term of "phosphates," and nitrates of soda and potash, usually designated "nitrates"? This is clearly attributable, however, not to a lack of knowledge of the scientific facts as they exist, but because of the different financial interest involved in the two

industries, thereby causing an undue advocacy of the particular chemical ingredient in which the several parties have embarked their capital.

The time is rapidly approaching when such a state of things must end; already those most largely interested in the nitrate industry have accepted the teachings of science in regard to this question of superiority or inferiority of the respective elements, and—appreciating the certainty of an almost universal demand in the future for a concentrated fertilizer containing all the beneficial qualities to be derived from a judicious combination of phosphoric acid and nitrate of potash—are alive to the necessity of securing a substantial interest in the comparatively limited supply of the crude phosphate rock.

The average farmer's knowledge of plant, physiology, and agricultural chemistry is, as a rule, of a very limited nature. He is not able to determine for himself what are, or what are not, those essential elements of food plants which he desires to procure for his land; but he is rapidly becoming educated up to a proper understanding of the various elements, and their relative value to the soil.

The literature published by the Royal Agricultural Society of England and the Bath and West of England Society is having a very beneficial effect in this direction, and the statistics and results of experiments therein published have in the past, and will still more in the future, clearly demonstrate that the very best results are to be derived, not from the use of nitrates or superphosphates alone, but by an intelligent use of the two in combination.

As evidence of this, Mr. J. E. Knowles, the chairman of the Experimental Committee of the Bath and West of England Agricultural Society (1888-89) states in his report that the results of twenty-four experiments in relation to wheat-growing showed "that nitrate of soda and sulphate of ammonia, when combined with superphosphate, have each given a larger produce both in corn and straw than either used alone." In the same publication the same satisfactory results were noted in reference to the oat crop. Experiments were made on $\frac{1}{2}$ -acre plots with the following results:—"The unmanured plots produced at the rate of 21 bushels per acre. By spending £1 1s. an acre in nitrate of soda (70 lbs.) and superphosphates (168 lbs.) the produce of grain was exactly doubled, and there was an increase of straw of 864 lbs., this increase in corn and straw being equal in money value to 2*l.* 10*s.*, or a clear gain, after deducting cost of manure, say, 30*s.* per acre."

"In the plots where sulphate of ammonia alone and nitrate of soda alone were used there was a small gain of about 6*s.* per acre."

Similar experiments on "grass" resulted as follows:—Unmanured, 4 cwt. 1 qr. per acre of hay; sulphate of ammonia, 5 cwt. 2 qrs. of hay; nitrate of soda, 5 cwt. 1 qr. 7 lbs. hay; nitrate of soda and superphosphates combined, 6 cwt. hay.

No clearer proof can be required to demonstrate beyond a doubt the unquestionable advantage of this combination, and it will be unnecessary, therefore, to trouble the reader with detailed results of the numerous other trials made.

That both the nitrate and phosphate industries have reached gigantic proportions, notwithstanding unreasonable opposition, may be gleaned from the following figures:—

	Tons.
Nitrates used annually in the United Kingdom and Continent.....	600,000
Nitrates used in United States (about)	90,000
Phosphates imported into United Kingdom alone (1887).....	283,415

Superphosphates and fertilizers mainly based on phosphates, used in the United States (1886)..... 1,006,631
Of this quantity 616,631 tons were used in the Southern States in the cotton districts.

It is difficult to estimate to what proportions this business may grow when a loyal combination is once established between the two interests, which, as we have pointed out above, must be the inevitable and speedy result of the march of progress and intelligent agricultural enterprise.

The question then arises—and it is a question which has given great concern to the manufacturers of fertilizers both in Europe and America during the past year—Where are we to look for our future supplies of crude phosphate rock which the satisfaction of this ever-increasing demand for plant-food necessitates? That the question is one of great moment for the consideration of manufacturers is evidenced by the serious anxiety evinced on this point by Mr. Herman Voss—himself the manager of one of the largest fertilizer manufacturing companies in the world—in his admirable paper read before the Chemical Manures Manufacturers' Association on 10th December, 1888. He therein stated:—"The consumption of phosphatic manures, partly owing to the use of large quantities of nitrate of soda and ammoniacal manures, is rapidly increasing all over the world, and our supply is at present dependent upon so few sources that I consider it necessary and advisable to change our mode of selling superphosphate in such a way that we could also draw from other sources which would strengthen our hands as manufacturers."

It will be noted that Mr. Voss not only expresses anxiety as to the present limited sources of supply of the crude phosphate, but strongly emphasises the fact we have demonstrated above, that any increased use of nitrate of soda, as a matter of course, will increase comparatively the demand for phosphatic manures.

The present imports of crude phosphate rock into Great Britain, as stated by Mr. Voss, are derived from the following sources (1887):—

	Tons.
United States.....	165,275
Canada.....	19,194
Dutch West Indies.....	9,505
British West Indies.....	6,451
Spain and Portugal.....	15,612
Belgium.....	45,322
Holland.....	4,778
France.....	11,140
Australia.....	350
Haiti.....	3,014
Brazil.....	1,200
Other countries.....	1,544

Total..... 283,415

From these figures it will be seen that to supply the requirements of Great Britain alone for the next ten years, provided the demand does not increase, will require an output of about 2,834,150 tons, and it is but reasonable to assume that long before the expiration of that time many of the older sources of supply, from which there has been a continuous drain for many years past, will be completely exhausted. On the other hand, it will be noted that the Canadian supply up to the present has only amounted to about 8 per cent. of the British consumption, notwithstanding the well established fact that the phosphate deposits in the Dominion cover such an enormous area as to warrant the assumption that in the near future Canada will take a foremost place in the world's supply of this invaluable mineral.

It will be noticed that the largest producing countries at the present time are the United States and Belgium. A reference to Mr. Voss's admirable paper shows that the average percentage of phosphate of lime in the Belgian product is not more than 50 per cent., while that of the United States contains about 60 per cent. The Canadian mineral, as imported into Great Britain averages, however, from 80 to 85 per cent. of phosphate of lime, and may at once be set down as one of the highest grades of phosphate rock the world produces.

When we take into consideration that, in order to produce a really high-grade phosphatic manure compound (for which intelligent agriculturists are year by year becoming more exacting in their demands), it is a necessity that manufacturers should procure a correspondingly higher grade of the raw material—and, if proof of this is necessary, it is to be found in the fact that makers are willing to pay a much higher price per unit of phosphate of lime for the richer minerals than they are for that of poorer quality; thus, for example, while a manufacturer is paying, say, 7*d.* per unit for a 50 per cent. phosphate, or 29*s.* 2*d.* per ton and 9*d.* per unit for one of 60 per cent., or 45*s.* per ton, he is willing to pay about 1*s.* per unit for the higher-grade Canadian, or 4*l.* per ton for an 80 per cent. grade, and 4*l.* 5*s.* for one of 85 per cent.—it must readily be seen that the Canadian miner must always be in a position to produce his material at a decided advantage over any of his foreign rivals.

The question then naturally arises, if this be the case, how is it that the present output is so limited?

The reply is to be found in Mr. Voss's remarks under the head of "Canadian Phosphates," as follows:—

The Canadian mines commenced to be worked some ten years ago, and the output now amounts to about 25,000 tons per annum. Our imports from Canada were:—

Years.	Tons.
1881.....	8,187
1882.....	16,531
1883.....	15,716
1884.....	21,484
1885.....	18,069
1886.....	19,194

So that it will be seen that in six years the output has increased about 250 per cent.

Capital is the agent most required in Canada to build up and develop her mining industries. With it much more could be accomplished; without it Canadians are unable to avail themselves to the full extent of their rich phosphate territory.

Canada offers to the British capitalist a large and profitable field for investment in her phosphate properties. As the great and vital question of the future supplies of fertilizing materials becomes more widely discussed capital will assuredly flow into Canada for the purpose of developing this profitable industry; but it behoves every Canadian, every man interested in the great future of this business, to see that the interests of the British investor are safeguarded by countenancing only those mining schemes which can bear honest investigation, and that will provide a fair and reasonable expectation of returning to those who invest their money in these properties a good and permanent interest on their capital. Otherwise, notwithstanding the glorious future opening out for those at present engaged in the business, capital will seek investment elsewhere, and the advancement of the colony, as well as its mining industries, will be permanently impeded.

The Value of Prospects.

Prospects should not be overlooked, for without them a mine is of no practical value. The enquiry should be made as to what the prospects are—whether of a temporary or a more abiding character. Not a few mining investors are unacquainted with what they buy. Because mining shares are offered temptingly by unprincipled men, they buy without weighing the statements made which are sometimes quite inconsistent. Caution should be exercised, and advice sought of those in whom reliance can be placed. When a rich mine has been discovered in a previously unknown district many other mines are soon started around it, but because one mine has proved exceedingly rich it does not follow, as a consequence that all the same neighbourhood will be rich. The character then of the district is not to be estimated only by the success of one mine, but by its geological and mineralogical features. Having considered the district in which the mine is situated; the reports severally and collectively should be perused, and the character and ability of the reports should not be overlooked. It is not an uncommon plan for capitalists and investors to send their own agents to give a special report, and as practical and experienced men can be obtained at reasonable rates, the safer course is to engage them when the mines are easily accessible. Should the company be a new one it is well to notice whether the projected adventure is an old or abandoned mine. Old mines are rarely abandoned with "riches in sight," but justifiable reasons can often be given for their abandonment, and then investigation is courted. Being satisfied thus far, it should next be ascertained what the extent of the property is, the length of the run of the lodes or veins which traverse it, and how the lodes lie one to another. Then the distribution of metals may be ascertained, whether abundant or otherwise, and the quality of the ore.

The development of a mine will have shown it rich in depth. So long as a mine continues to open out rich in depth, and the value of the "ends" or drivings keep up, then the investor may rest assured that the mine is a good one. The reserves should not have been unduly entrenched upon, because on their success greatly depends. They are the dividends in embryo, the cash to come, the something to fall upon while explorations are being carried on in other parts of the mine. A good manager will always endeavor to keep up a two or three years reserve of ore, and to open up new ground at the same rate he is taking ore out of the mine. When large bodies of ore have been raised from a mine, unless precautions have been taken, serious accidents may occur which would endanger the prospects. "Slips" and "cavings in" sometimes occur, and, where these are likely matters become grave.

Coal Mining in Alberta

(Vancouver Daily World.)

There are few persons at present who are aware that Canmore, Alberta, is destined in a short time to rival as a coal producing centre, the far-famed Newcastle of England. Few persons will believe that within the beautiful valley of the Bow River, extending from Banff past Anthracite and Canmore to a point where the railway enters the Rocky Mountains, lies one of the finest coal regions on the continent. The coal found here is pronounced by experts to be of a superior quality to that of the famous Anthracite coal of Pennsylvania, and in a loca-

tion easily accessible to the Canadian Pacific Railway. Through the untiring efforts of Mr. C. Brinckerhoff, who, representing a St. Paul syndicate, has spent the past two years in prospecting the section for coal, is the public indebted for the valuable find that will revolutionize the coal trade of the whole Pacific coast. He has secured for his company several sections of the most valuable coal lands in the district, and is at present at work upon a splendid vein, 14 feet 2 inches in thickness, having a pitch of about 54 degrees, into which they are sinking a large shaft, having now reached a depth of 140 feet, the men working in three shifts of eight hours each, a number being employed outside the shaft in handling the coal, while another large force is at work on the numerous buildings being erected for the use of the company and the accommodation of the miners, for whom ample provision is being made. The dining room is at present capable of seating 40 men at one time, and will be enlarged when necessary. The sleeping quarters will accommodate 32 men and are perfect models of comfort and elegance, while, to make everything complete, a library and reading room is to be erected at once, in which will be kept all the latest newspapers and magazines, showing a liberal forethought on the part of the company.

In order to reach the railway from the mine an inclined plane is to be run from the head of the slope to the river bank, where the coal will be dumped into a large breaker, and discharged from it into the cars which are to be run out on a spur of the track from the station, nearly a mile distant. This portion of the work is to be commenced at once; and, as repeated tests have been made of the coal by President Van Horne, Superintendent Whyte and several engineers along the line, all of whom pronounce it the best they have ever seen, assures the ultimate success of the mines and the future greatness of Canmore as a mining centre.

The Canada Anthracite Coal Company are also making rapid strides in the development of their mines here, and are shipping several cars per day to Port Moody for transhipment to San Francisco. The understanding now is that their headquarters are soon to be removed from Anthracite to this point.

Non-Conductivity of Mineral Wool.

—The mineral wool consists of a mass of extremely fine interlocking fibers which form multitudes of minute air-chambers, to which is due the non-conductivity of the substance. The fiber is, however, extremely glass-like and brittle, and will not bear much handling. It doubtless merits the reputation which it has, of becoming broken and pulverized by repeated heating and cooling, and by the vibrations and jarring of steam-pipes. The powder then collects at the bottom of the paper bags, leaving the top of the pipes comparatively unprotected. This reputation the mineral wool shares with the asbestos fiber, but is certainly more entitled to it than the latter substance. Much has been said of the corrosive action of mineral wool upon iron pipes, and Prof. Egleston, in a paper read before the American Society of Civil Engineers, has demonstrated that under certain adverse conditions such a corrosion does take place. But it is probable that mineral wool made from slags that are free from sulphates and sulphides, those of lime particularly, will not be liable to this objection, especially if dampness of the coverings be avoided.

Detecting Minute Quantities of Iron in Minerals.—Alexander Johnstone, F. G. S., assistant to the professor of geology and mineralogy in the University of Edinburgh, states a new and rapid method for detecting minute quantities of iron in mineral as follows:

By means of a good strong flame, produced in the ordinary way by the mouth blowpipe, heat for a minute or two a small portion of the mineral, preferably in a powdered condition on clean platinum foil, with about four times its bulk of potassium nitrate or chlorate. The platinum should be heated from below, as it is not desirable that the flame should touch the assay. After the mass has been ignited, as stated, add to, *before it has cooled down*, by means of a piece of glass tubing, pure concentrated nitric acid, drop by drop, until not a single drop remains dried up. Next pour on to the top of the unevaporated nitric acid, also by means of a narrow glass tube, two or three drops of an aqueous solution of potassium sulphocyanide. A distinct red coloration will immediately arise and remain if any iron was present in the mineral examined. As this test is extremely delicate, nitric acid quite free from iron must be obtained; and it is essential that the potassium nitrate or chlorate should also be pure. The platinum foil must be perfectly clean, and the dropping tubes must be rinsed with water before and immediately after the application of each test.

Chlorination Works for the Lake of the Woods.

The indications are that the mineral deposits of the Lake of the Woods region are to be developed at last. The question of titles having been settled and everything made clear for the safe investment of capital, a company has come forward to establish works for treating ores, and promise to be turning out bricks of gold within three months. Mr. Henry J. Power who has been interesting himself in the scheme and who has just returned from Chicago, says that he has arranged to erect Chlorination Works at Rat Portage for the purpose of treating all kinds of gold and silver ore, even when the latter is carrying up to fifteen per cent of lead. By the chlorination process the ore is crushed, then pulverized, then subjected to electrified terraced plates, after which it goes through the pans, then through the agitators and finally concentrated. This process is repeated until the gold or silver is thoroughly separated from the ore. The plant necessary for the works is not very expensive, but is complete and will have capacity for all the ore that can be supplied. Mr. Power has arranged with companies owning mines to begin developing in time to have ore on hand by the time the mills are finished. Mr. Power is a practical miller, and has had experience either as proprietor, manager, miller or assayer in Michigan, the Black Hills, Colorado, Utah, Wyoming, New Mexico, Texas, Arkansas and other places. He believes that the minerals in the Lake of the Woods have good values and will give a good return. The people of Rat Portage have voted \$10,000 to aid the new works.

Shipments of British Columbia Coal.

The shipments of coal from the port of Nanaimo for month ending 30th June were:

Vancouver Coal Co.....	13,393 tons.
Dunsmuir & Sons.....	18,204 "
East Wellington Colliery....	1,884 "
Union Colliery (Comox)....	4,500 "

Sinking Appliances at Llanbradach.

An Interesting Paper Descriptive of a Plant in Which the Author has Applied Successfully a Number of Original and Useful Ideas.

BY W. GALLOWAY.

[From Proceedings of the South Wales Institute of Engineers.]

The sinking at Llanbradach has been undertaken by the Cardiff Steam Coal Collieries Company, Limited, for the purpose of winning and working the well-known steam-coal seams of the district. The shaft now being sunk is situate close to and on the west side of the Rhymney Railway, at a distance of $11\frac{1}{2}$ miles from the Bute Rocks at Cardiff, and it is thus about midway in a direct line between Pontypridd, at the bottom of the Rhonda Valley, and Risca Colliery, near the southeastern outcrop of the coal-field.

The great anticline which traverses the coal-field from west to east crosses the Rhymney Valley nearly at right angles to its general trend, at a point about half-way between Energlyn and Maes-y-Cymmer. Accordingly, if we follow the undulations of any seam passing from the south outcrop through the town of Caerphilly in a direction almost due north, we find the following changes of dip to take place: From the south outcrop the dip is towards the north, very rapid at first, and then more gradual, until the axis of the southern syncline is reached near the town of Caerphilly. The strata then rise toward the north, attaining a maximum rate of dip near Energlyn, and thereafter becoming gradually flatter until the summit of the anticline is passed, when they again dip towards the north at a moderate angle. The site of the shaft in question was chosen at a point about half a mile south of the summit of the anticline, principally with the object of avoiding the proximity of the two great faults which formed the northeast and southwest boundaries of the workings in Powell's Gelligaer Collieries.

The seam of coal worked in the southern syncline at Caerphilly, and known by the name of Llantwit or Maes-mawr, is either identical with, or, at any rate, occupies nearly the same geological horizon as that which was formerly worked in Powell's Gelligaer Collieries, and is still worked on a small scale in the same neighbourhood. It forms the upper limit of what is known as the Pennant sandstone series, which has a thickness of about 500 yards, or rather less, along the line of our imaginary section, being probably somewhat thicker towards the north than towards the south. It crops out in the northern rise near Energlyn, already referred to; and although the hills on each side of the Rhymney

Valley near Llanbradach rise to a height of upwards of 1,000 feet above sea-level, as far as at present known, they contain no vestiges of it. The mouth of the shaft at Llanbradach, on the other hand, is somewhat less than 400 feet above sea-level, and it follows that it will have to traverse about one-half the thickness of the Pennant series, including the ground occupied by the rock seams of the south outcrop, before reaching the Shale series proper.

Under these circumstances the Company elected to sink one shaft to ascertain the exact depth of the steam-coals, and to serve as an up-cast to the future colliery, before deciding upon the more important equipment of the principal winding shaft; but, at the same time, they determined to fit out this shaft in such a substantial manner as to be able to cope with all difficulties likely to be met with in sinking in

the ground which overlies and encloses the rock seams of coal in the Caerphilly hills.

The working pressure of the steam boiler at Llanbradach was fixed at 150 pounds per square inch, with the view of profiting as much as possible by the most recent improvements in steam-engine practice, such as working expansively either with or without compound or tripple-expansion engines. Only one boiler has been required up to the present; it is of the Lancashire type, is 8 feet in diameter by 30 feet long, consists entirely of steel plates, and was built and tested to a pressure of 250 pounds on the square inch, under the advice and supervision of the Boiler Insurance and Steam Power Company of Manchester.

A temporary brick chimney, only 30 feet high, was built in a position suitable to receive the products of combustion from two boilers of the

dimensions given above, as it was intended from the first to apply a forced draught until such time as the permanent chimney is provided. The forced draught is now applied in the following way, with the most satisfactory results: An air-tight chamber built of brick, provided with two wooden doors and an iron roof in which there is a window of thick plate glass, has been built in front of the boiler, the brick-work enclosing the boiler-front constituting one of its sides. A sheet-iron tube, 18 inches in diameter, branches from the pipe which ventilates the shaft at a point near to the ventilating fan (a 40-inch Schiele), and is led into one corner of the air-tight chamber, on the side furthest removed from the boiler-front, and there turned upwards at right angles, so as to blow the air towards the roof. In this manner a pressure equivalent to a column of water one inch high can be maintained inside the chamber, creating an excellent draught

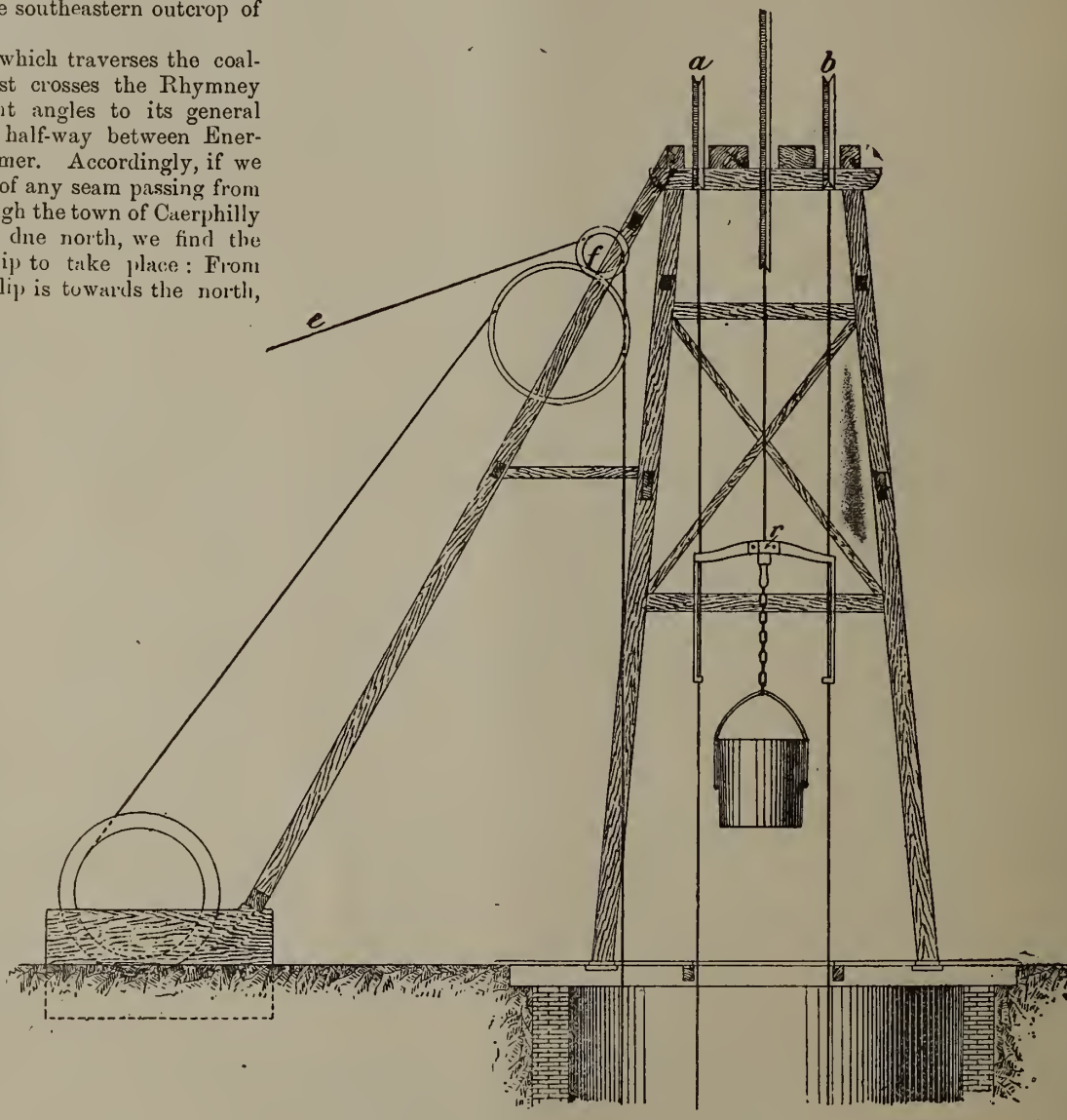
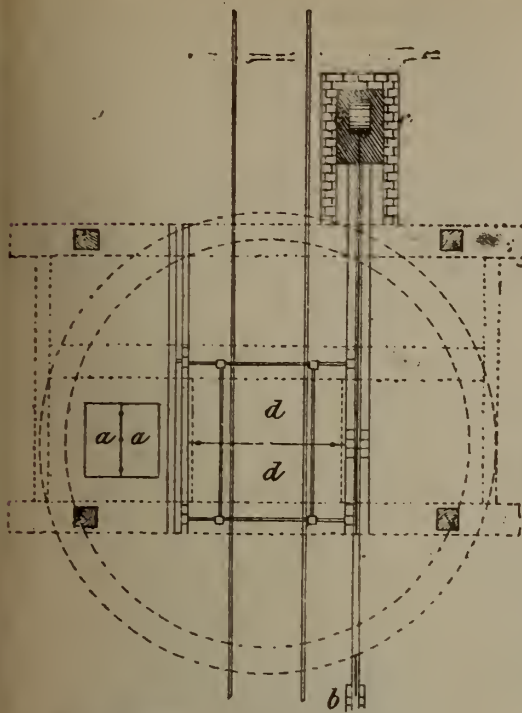


Fig. 1. Guides. Elevation. Scale, $\frac{1}{2}$ in. = 1 ft.

ground such as has been described, and to act, in case of need, as a powerful auxiliary in winding coal from the greatest depth likely to be attained.

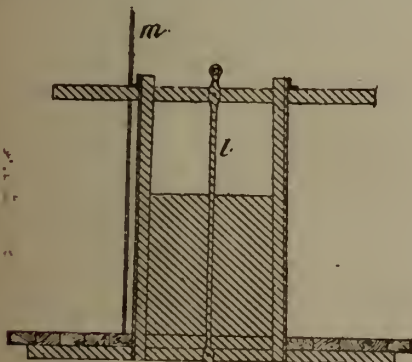
The shaft is 17 feet in diameter when finished, and is to be lined with brickwork throughout its entire depth. It is now (November 1, 1888,) 200 yards deep, and has passed through strata of a similar character to those found in Albion Colliery—saving only that the shales are thinner as a rule, and the sandstones thicker. This change in the nature of the strata was to have been anticipated, from the consideration of what takes place between Lady Windsor and Albion Collieries, and, again, between the latter and

through the boiler furnaces. The interior of the chamber is quite cool. The ventilating pipe leading to the shaft, and the branch leading to the air-tight chamber, are each provided with a loose-working throttle valve immediately beyond their point of junction with each other, whereby more or less air can be sent down into the shaft or into the air-tight chamber, as may be desired. The fan is worked by a belt from a small compound engine, with cylinders 6 inches and 12 inches in diameter respectively, by 8-inch stroke, expanding in the ratio of 8 to 1 when the valves make their full stroke, whereby the steam is cut off at five-eighths of the stroke of the pistons. The speed of the engine and fan is regulated by

Fig. 2. Guides. Plan, Scale, $\frac{1}{4}$ in. = 1 ft.

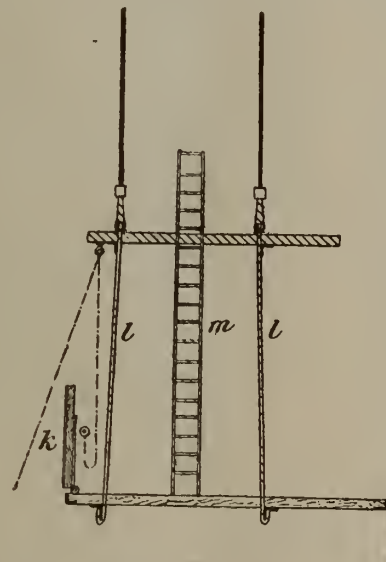
means of a screw-wheel inside the air-tight chamber, which actuates the links, giving an earlier cut-off when desired.

The feed-water passes through a Green's fuel economizer, in which it is heated before entering the boiler by means of the waste furnace gases, on their way to the chimney, after they have left the boiler-flues. The fuel economizer has 48 vertical pipes, each 9 feet long by $3\frac{1}{4}$ inches in diameter, and heats the water nearly to the boiling point. It was considered better to heat the feed water in this way than by turning the exhaust steam of the winding and other engines into it, as the oil and tallow used in lubricating the slide valves and pistons would otherwise have been apt to form a hard cake on the top of the boiler-flues, more especially with the high temperature of the water within the boiler—about 357° Fahr. Besides this, an opportunity was left of condensing the steam from these engines, and obtaining the advantages of a vacuum; and the temperature of the feed-water was likely to be more uniform than if heated at irregular intervals, as it would have been by the exhaust steam from the winding engine of a sinking shaft.

Fig. 3. Walling. Scale, $\frac{1}{4}$ in. = 1 ft.

The shaft now being sunk is, as has been already mentioned, intended to serve as the upcast, and it was, therefore, not considered essential to make the principal winding engine a compound one. Besides, the author was aware of the difficulties that had attended the introduction of compound winding engines in other districts, both at home and abroad, and wished to investigate the question experiment-

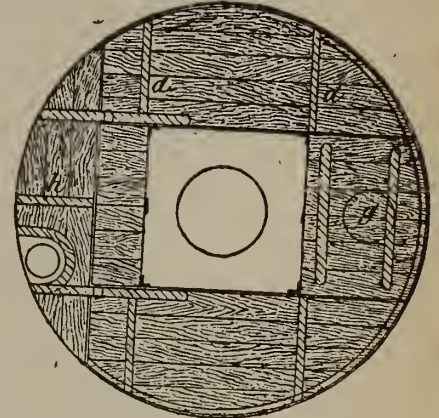
ally on a smaller scale, by means of another auxiliary winding engine, before applying the principle on a larger scale. The solution of this question which had presented itself to the author was the introduction of a reducing valve, properly so-called, between the steam-pipe leading from the boiler to the high-pressure cylinder and the pipe connecting the high and low pressure cylinders, regulated in such a manner as to maintain the pressure in the intermediate pipe, when the engine was not at work, as nearly as possible at the same average as the steam in that passage would naturally assume when the engine was working. In order to limit the quantity of steam passing through the reducing-valve to the smallest quantity necessary to accomplish the object in view, a screw stop valve was to be introduced in the pipe connecting the reducing-valve with the high-pressure steam-pipe, and a steam-pressure gauge on the intermediate pipe itself, for the purpose of enabling the reducing-valve to be properly regulated. Accordingly, in May, 1887, when specifying the details of a small auxiliary compound winding-engine to be employed in lowering bricks and mortar on to the walling stage, &c., the author included the reducing-valve, stop-valve, and steam-gauge, arranged as described above. This engine was erected at Llanbradach in October, 1887. It is identical with the fan-engine pre-

Fig. 4. Walling. Scale, $\frac{1}{4}$ in. = 1 ft.

viously described, except as regards the reducing valve, the steam stop-valve connected therewith, and the steam-pressure gauge; and it is connected to a drum, five feet in diameter, by means of helical spur-gearing in the ratio of six to one. Some preliminary difficulties were caused by the makers having, of their own accord, made the slide-valve of each cylinder to cut off steam at five-eighths of the stroke; but after the valves had been cut so as to admit steam during the whole length of the stroke, these difficulties entirely disappeared, and thereafter this compound engine became as satisfactory, and as easily controllable, as any other winding engine with two cylinders.

At first it was employed only for the purpose for which it was originally intended, but at a later date it became expedient to use it for raising water from a collecting cistern fixed on one side of the shaft, and then the great saving of steam effected by compounding became very marked, when its performance could be compared with that of the large winding-engine which had previously raised the same water from the bottom of the shaft at the same depth. As the author intends to describe more particularly the method in which this water is collected

and raised, at a later stage of the paper, he will only say in this place that this engine, before the last remove of the cistern in the shaft, raised water from it continuously day and night, with one rope, from a depth of 135 yards, at the rate of 30 to 35 tanks (2,500 to 3,000 gallons) an hour to the 20th of October, when the cistern was removed to a point 190 yards deep. From the latter point the same engine raised temporarily 25 tanks (2,125 gallons) an hour; but as the cistern collects over 5,000 gallons an hour, it became expedient to apply a stronger engine and a larger tank to the same end.

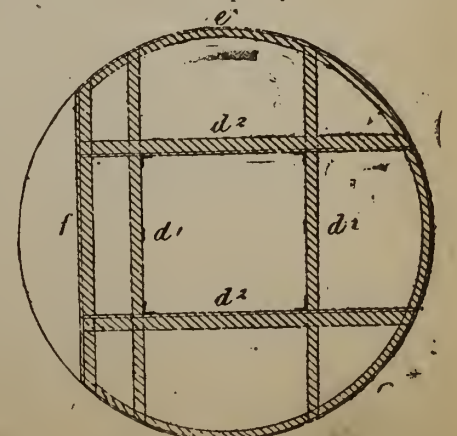
Fig. 5. Walling. Scale, $\frac{1}{4}$ in. = 1 ft.

The principal winding-engine has two cylinders, each 24 inches in diameter by 4-feet stroke, connected directly to the shaft of a drum 14 feet in diameter. It is provided with equilibrium slide-valves and Allen valve-gear, and the dimensions of its principal parts are as follows:

Piston-rods, 5 in. dia.
Connecting rods, 5 in. dia. at the ends.
Crank pins, 6 in. dia. by 8 in. in the bearings.
Drum-shaft, 11 in. dia. by 18 in. in the bearings.
Drum-shaft 13 in. dia. in the drum-heads.
This engine was built by the well-known firm of engineers, Llewellyn & Cubitt, of Penter Pontypridd, and has continued to give unqualified satisfaction since the first day it commenced to work. As the author anticipated, it works as smoothly, and is as easily handled, at the high pressure as a larger engine is at a lower pressure. In ordinary work it raises 9,500 lbs., consisting of

Rope, say.....	800 lbs.
Water-barrel.....	2,500 "
Water	6,000 "
Rider..	200 "
	9,500 lbs.

at the rate of 30 feet per second, thereby developing over 500 horse-power; but this is not by any means the limit of its capacity.

Fig. 6. Walling. Scale, $\frac{1}{4}$ in. = 1 ft.

The loads raised and lowered by each winding-engine are steadied by means of wire-rope guides, applied according to the system patented by the author in 1875, and first made use of in that year at Penrhwyf Colliery, belonging to the Glamorgan Coal Company. There are two guide-ropes to each engine, one on each side of the winding rope, and the three ropes of each system hang in the same vertical plane, one system, in this case being at right angles to the other.

At the surface, the guide-ropes of the principal winding engine pass over pulleys, *a*, *b* (Fig. 1), and are coiled upon the drums of a screw steam-crab at some distance from the shaft. These drums can be worked either separately or simultaneously, so that one guide-rope can be raised or lowered by itself, or both can be raised or lowered together. The lower extremities of these two guide-ropes are attached to the walling stage (Fig. 4).

The rider, *r* (Fig. 1), consists of three principal pieces of iron, namely: a cross-bar in which there is a central opening three inches in diameter, which fits loosely around the winding-rope, and two vertical lgs bolted to the cross-bar, and having similar openings about two inches in diameter for the guide-ropes, both at their upper and lower ends. A circular iron plate, six inches in diameter, rests in a horizontal position upon the cap of the winding-rope,

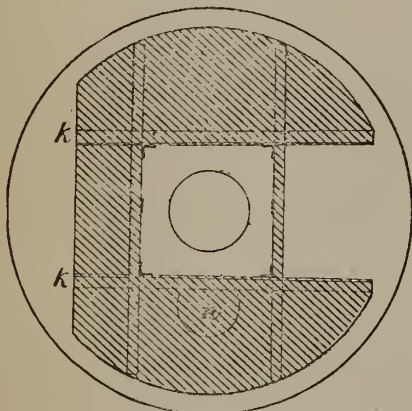


Fig. 7. Walling. Scale, $\frac{3}{8}$ in. = 1 ft.

and serves as a base for an india-rubber buffer, six inches in diameter by six inches thick, which surmounts it. The extremities of the guide ropes are provided with similar india-rubber buffers, 4 inches in diameter by 4 inches thick. When the end of the winding-rope is raised above the walling stage, the rider is caught up by the buffer at its end, and slides on the guide-ropes; on the other hand, when the end of the winding-rope passes below the stage, the rider is left standing upon the buffers at the ends of the guide-ropes, while the load can be lowered to any desired depth through a central opening in the stage. By this arrangement the stage is permanently suspended in the shaft, and is ready at a moment's notice for any service that may required of it; and the buckets, &c., are as quickly and easily steadied (whatever the depth of the shaft may be) as if the winding-rope was not longer than the distance between the stage and the bottom, which, for convenience, is usually about 15 or 20 yards.

In former applications of this system, the stage consisted of a simple wooden disc, suspended by means of chains to the ends of the guide-ropes, and having a central opening 6 feet square, through which the load passed upwards or downwards, as the case might be. At Llanbradach the stage is a much more substantial structure, and may here deserve notice as an improvement upon its predecessors. It is repre-

sented in Figs. 3, 4, 5, 6 and 7, and consists of the following parts, viz.:

a. A wooden floor (Fig. 5), partly fixed to an angle-iron frame, partly movable.

b. An upright tube (Fig. 3), fixed to the iron frame of *a*.

c. A horizontal iron frame (Fig. 7), fixed to the pieces of angle-iron which form the corners of the tube.

The lower frame (Fig. 6) consists of four pieces of angle-iron, d^1, d^1, d^2, d^2 , 5 inches by 5 inches by $\frac{5}{8}$ inch, crossing, each other, two and two, at right angles; a circular band of angle-iron, *e*, *e*, 4 inches by 4 inches by $\frac{1}{2}$ inch, in three segments, joined to the ends of six of the pieces d^1, a^2 ; and a straight piece of angle-iron, *f*, 5 inches by 5 inches by $\frac{5}{8}$ inch, joined to the shorter ends of d^2, d^2 , and to the ends of the circular frame, as shown.

Part of the wooden floor *g* (Fig. 5), is bound together by means of four straps of iron, two above and two below. One of its ends rests on the circular angle-iron, and the other on the cross-piece, d^1 ; but it is not fixed in any way, and can be lifted out of its seat and removed when desired.

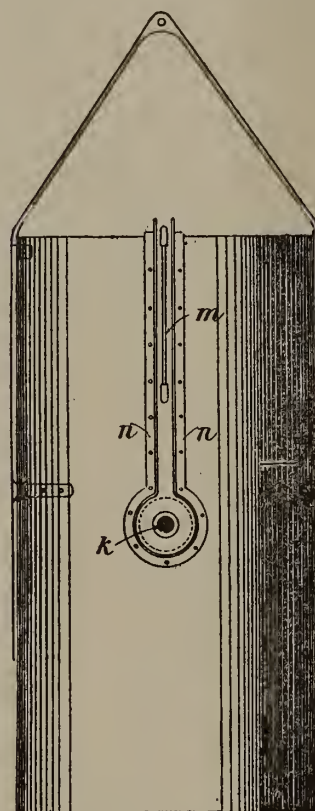


Fig. 8. Pneumatic Water-Barrel. Scale, $\frac{3}{8}$ in. = 1 ft.

At the other side of the stage there is a hinged door, *h*, forming the smaller segment of the circle, which can be raised up into a vertical position as shown in Fig. 4, or let down into a horizontal position (Fig. 5). It is held in the latter position by two chains attached to the ends, *k, k*, of the frame-work of the roof. When the stage is taken past the pipe buntons, this door is raised up. It is provided with an opening large enough for the ventilating-pipe. All the timber is 5 inches thick, and, except that which constitutes the hinged door and the part *g*, it is all bound strongly to the iron frame-work. The latter is held together by $\frac{3}{4}$ inch rivets.

The tube consists of four upright corner-pieces of angle-iron, 5 inches by 5 inches by $\frac{5}{8}$ inch, which connect the upper frame with the lower one. Four plates of sheet-iron $\frac{1}{4}$ inch thick, attached to the four uprights just named, form a fence 6 feet high round the central opening in the stage, which is 6 feet 6 inches square.

The roof is 10 feet 6 inches above the stage proper. It is formed similarly to the floor, has a rather smaller diameter, and is covered with sheet-iron $\frac{3}{8}$ inch thick, except above the door and moveable part *g*, which are left uncovered. Its central opening is 5 feet 6 inches square.

The tube has thus the form of a frustum of a quad-rangular pyramid.

The stage is suspended from the guide-ropes as shown in Fig. 4, the caps at the ends of the ropes being attached directly to the eyes of the

suspending rods, *l*, one on each side of the centre of the shaft. An iron ladder, *m* (Fig. 4), provides a means of access to the roof, and *vice versa* through the opening, *n*, in the sheet-iron cover.

The guide-ropes are made of steel wire; each of them is $3\frac{1}{2}$ inches in circumference, and is calculated to have a breaking strain of 33 tons, or thereby. The stage weighs about 5 tons, or a little over. The guide-ropes are 5 feet 6 inches apart, center to center, so that the center of each is 2 feet 9 inches distant from the center of the winding-rope.

The top of the shaft is covered with 4-inch planking, except over the two areas occupied by the two pairs of balanced doors, *a, a* and *d, d*

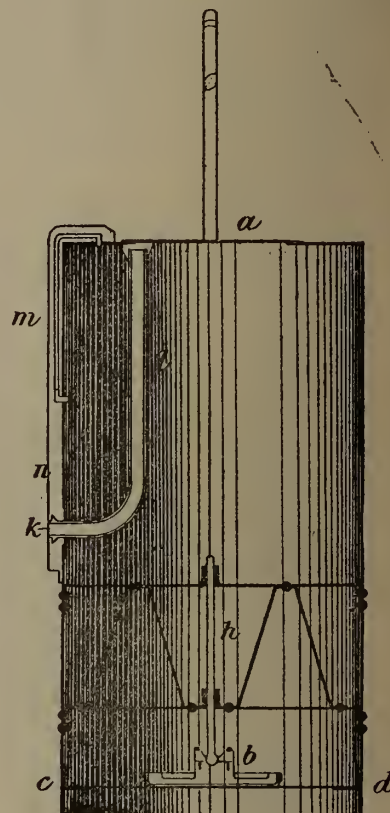


Fig. 9. Pneumatic Water-Barrel. Scale, $\frac{3}{8}$ in. = 1 ft.

(Fig. 2), The balance-weight of the doors *d, d* is shown at *c*, and the lever at which they are opened and shut at *b*. The corresponding balance-weight and lever of the doors *a, a* are omitted from the drawing for the purpose of avoiding complication. Suffice it to say that both pairs of doors are balanced in every position—open, shut, or intermediate.

In all former applications of the system the cranks, rods, and levers which connected the doors with the balance-weights, and with the handle for manipulating them, were overhead. At Llanbradach they have been brought down to the same level as the covering of the top of the shaft. The rider is shown at *r* (Fig. 1), with a bucket suspended below it. The buckets are 3 feet 9 inches in diameter at the top, 3 feet 4 inches in diameter at the bottom, and 3 feet 6 inches deep, so that each contains about $34\frac{1}{2}$ cubic feet when filled to level with the top. They are emptied into triple-center, side, and end tipping wagons of steel, without being detached from the winding-rope.

(To be Continued.)

Acknowledgment.—We are indebted to the courtesy of the Colliery Engineer Co., Scranton, Pa., for the use of the cuts illustrating the foregoing paper by Mr. W. Galloway.

PHOSPHATE.

Ocean Shipments.

The following is a statement of the Shipments of Canadian Phosphate from the port of Montreal since our last issue to 8th July :—

Date.	Vessel.	Destination.	Shipper.	Tons.
June 10.	Ripon City.....	Hull.....	Millar & Co.....	260
" 13.	Saturnina.....	Liverpool.....	Wilson & Green.....	401
" 21.	Zambesi.....	".....	Millar & Co.....	300
" 25.	Montreal.....	".....	Lomer, Rohr & Co.....	270
" 27.	Lake Ontario.....	".....	Lomer, Rohr & Co.....	200
July 3.	Vesta.....	Glasgow.....	Wilson & Green.....	200
" 6.	Colina.....	".....	".....	15
" 8.	Etna.....	Hamburg.....	".....	244
				1890

RECAPITULATION.

Lomer, Rohr & Co.....	470 Tons.
Wilson & Green.....	860 "
Millar & Co.....	568 "
Total.....	1890
Liverpool.....	1371 Tons.
Hamburg.....	244 "
Glasgow.....	15 "
Hull.....	260 "
Total.....	1890

The estimated value of phosphates exported from the Kingston district during April and May, as per Customs returns, was \$3,940. Of this 279 tons were shipped to Great Britain.

A little over 1000 tons have been shipped to European points from the Blackburn mine, Templeton, since opening of navigation.

British Fertilizer Market.

We are indebted to Messrs. Couper, Millar & Co., London, for the following report of the British Fertilizer market since our last issue :—

Since the issue of our last circular, business has been somewhat restricted, manufacturers holding off, as they are unwilling to believe in the advance in the price of phosphates which has been established. Within the last few days there has been more disposition to contract for next season's requirements, and the continental demand continues active, more especially for high test. The prices ruling in America for South Carolina restrict shipments to Europe, and the demand there in the immediate future is more likely to increase than diminish. Nitrate of soda is firmer, even though the season's demand is about over, while sulphate of ammonia is very steady.

Mineral Phosphates.—Canadian is more appreciated on continent than in U. K. For 80 per cent. 1/0½ ex ship London and Liverpool may be considered to-day's price, with 75 per cent. at 11d. and 70 per cent. 10d. per unit, all with one-fifth of 1d. rise. South Carolina 9¾d. to 10d. Somme, of the higher tests, enquired for, but not to be had except at extreme prices. Belgian 40 to 45 per cent. and 45 to 50 per cent. we are sellers of, prices according to port of discharge.

Bone Ash, Bones and Meal.—No enquiry for ash cargoes, but more disposition to operate in bones forward. Bone meal dull and sales of Bombay at £4 13s. 9d. to £4 15s. 0d.

Nitrate of soda firmer at £8 7s. 6d. to £8 10s. 0d.

Sulphate of ammonia very steady at £12 2s. 6d. per ton.

Ammoniacal materials wanted. Fish Guano and ground hoofs and horns we have sold for-

ward, but can still offer more. Dried blood does not command so much attention, prices asked being comparatively much too dear.

Muriate of potash is quoted at £7 5s. on 80 per cent. ; Kainit at 23/6 in bulk, 26/6 in bags, and Kieserit at 17/3, all f.o.b. Hamburg, subject to open river navigation. Net cash. Strassfurt weights and sampling.

In General.

The Hon. Gerald McGarel Hogg (son of Lord Magheramorne, K.C.B., late Chairman of the Metropolitan Board of Works, London, England), who spent last summer in Montreal studying the phosphate interests of Canada, has been admitted as a partner in the firm of Messrs. Couper Millar & Co., London, England, the well known phosphato importers whose Montreal House Messrs. Millar & Co. are the agents for the Canadian Phosphate Company, Limited.

Captain R. C. Adams, Managing Director of the Anglo-Canadian Phosphate Company, returned from England on the 5th instant.

Enquiries for Canadian phosphate lands have been numerous, but only from speculators who desire to offer them to the public. The response to such efforts as have been made in this direction have discouraged the promoters. There is no doubt, however, that an interest is being awakened in the Canadian industry that will eventually lead to the investment of British capital, and it seems certain that phosphates have a good commercial future.

Contract work for the Anglo-Canadian Phosphate Co. proceeds at the Otty Lake and Bobbs Lake Mines. The output for the past month at Bobb's Lake averages eight tons per man employed, a very satisfactory result. This property has developed so well that the management contemplate putting an enlarged system of day's work into operation.

Mr. W. Hamilton Merritt, M.E., Toronto, spent a few days last month examining a property near the High Falls, Lievre river, Que., in which Mr. Dalton McCarthy, Q.C., has a large interest. Foreman Holmes and a small force are doing development work here, and have opened up a number of shows which promise well.

Markets.

Markets are firmer and lower grades of phosphate may be quoted at 10d. for 70 per cent. an advance of 1¼d. since the season opened. There is some enquiry for 60 per cent. phosphate. Eighty per cent. is quoted at 12½d.

Safe Transportation of Sulphuric Acid.

—Herr Bickmann has patented in Germany a process for enabling sulphuric acid for manufacturing purposes to be safely transported. He takes advantage of a property of certain salts—of which alkaline sulphates are representatives—by which they give up their water of crystallization when heated, and take it up again when cool; and he does so by mixing the salts in an anhydrous condition with a calculated quantity of sulphuric acid. The whole mass becomes granular, or may be formed into cakes; and when heated the whole liquefies, and may be used as if it were sulphuric acid, for the presence of bisulphate of soda does no harm in many utilizations of the acid.

MINING NOTES.

We shall be greatly obliged to mine owners and superintendents for such authentic reports of their operations as may concern shareholders and the public.

Nova Scotia.

At the Annual Meeting of the Gold Miners' Association of Nova Scotia, held at Halifax, on 6th March, a resolution was passed adopting the "Canadian Mining Review" as the official organ of this Association.

Chester Basin.

Mr. C. E. Willis, manager, started the mill of the Neptune Gold Mining Co. last month. He reports the mill excellent in every respect, and says he has "the best little mill in the Province." Up to date the mill has crushed at the rate of 18 tons in 24 hours. The stamps, engine and boiler were furnished by I. Mattheson & Co., of New Glasgow.

Chezzetcook.

Mr. J. L. Graves, of Boston, has been making another test of his property here, preparatory to deciding whether he will continue work or close down indefinitely. Some work was done upon this property last fall, but with no encouraging results.

North Brookfield.

The Philadelphia Gold Mining Co. have contracted with I. Matheson & Co., of New Glasgow, for a 20 stamp mill complete, with a 60 h. p. boiler, and an engine. The company have hitherto used the mill owned by Mr. McGuire, operating it under a lease. This lease is about to expire, and the management feel secure enough of the prospects of the mine to build a larger and better mill of their own.

Miscellaneous.

At the regular monthly meeting of the Gold Miners' Association on the 5th July Mr. J. S. McArthur, of Scotland, was a guest, and explained to the members present the process which the Cassell Gold Extracting Co., Ltd., of Glasgow, Scotland, are now trying to get adopted in the gold fields of both Australia and the United States. Mr. McArthur, who is the technical manager of the Cassell Co., stated that they now had four different companies using their process with success in Australia. The process is patented in Great Britain and the colonies and in the United States. The process is essentially one of solution and precipitation, the solvent being a dilute solution of Cyanide of Potassium. It is claimed that 85% is extracted at a cost of less than \$20 per ton.

The Nova Scotia Iron, Coal and Railway Co. (Limited) has been organized under Charter granted by the Local Government, and the long talked of smelting works now bid fair to become a reality. The directors of the new concern are: J. P. Mott, Halifax, President; Graham Fraser, Glasgow, Scotland, Vice President; J. F. Stairs, Halifax, Thos. Bayne, Halifax, Wm. Jacks, ex-M. P., Glasgow, Forrest McKay, New Glasgow and Harvey Graham, New Glasgow. It is proposed to proceed at once with a thorough examination of their iron ore properties, and should the prospects prove satisfactorily, the erection of the furnaces and necessary plant will be at once begun. Those who look hopefully forward to the successful establishment of iron

smelting works in this district, must be gratified to find on the board of directors the names of gentlemen who have been associated with the iron industry of Pictou County from its infancy, and to whose skilful management and thorough business ability, the Nova Scotia Forge Co. and Nova Scotia Steel Co. (now amalgamated) owe their existence and their present prominent position among our local industries.

There is some improvement in the coal trade in Pictou County and this is particularly noticeable at the Drummond Colliery, where work of late has been fairly brisk, yet not sufficiently so to warrant the reopening of No. 4 Slope and the Scott pit, although rumours are current that the latter will be re-opened at an early date.

At the Black Diamond Mine work is, as usual, steady, any stoppage of work at this colliery having not as yet been due to any lack of orders. Another Slope is soon to be opened here for the purpose of winning an extensive block of coal of excellent quality; it is always gratifying to report the success of this enterprising company, while the harmony which exists between the management and workmen is certainly worthy of notice, and cannot fail to be productive of lasting benefit to all concerned.

At the Acadia Colliery work is also somewhat steadier, and the sinking of the new lift is progressing satisfactorily. There is some talk of a new hoisting engine being erected here, this will, however, be a necessity of the future, and will no doubt when erected be fully in keeping with the other machinery at the place, first class in every respect.

At the Albion Mines, the Acadia Company—not discouraged by frequent interruptions and a heavy expense—are pushing vigorously forward with the re-opening of the Foord Pit, Cage Pit Seam, and No. 1 Slope. A new steam pump (Knowles') has been put to work in No. 1 Slope, and good progress is being made with the drainage of the water. At the Foord Pit, despite many difficulties encountered, care and perseverance still characterise the conduct of the work, and the obstacles are gradually, but surely, being overcome. It is predicted by knowing ones that in another month the bottom of the shaft will be reached; your correspondent is one of many who hope for even better things. Very little coal is at present being raised at the McGregor pit, and miners employed there must, indeed, be feeling the pinch of hard times.

At the Vale Colliery work is exceptionally dull just now, only the McBean Seam being worked and very irregularly at that. This mine has recently been visited by several parties interested in the proposed new Iron Works, it is said with a view to purchase. Should the colliery pass into the hands of an iron company, it would doubtless be a means of providing steady work for the men employed there.

Ontario.

Application for incorporation is made by the National Gas and Oil Company of Canada with offices at Windsor, to carry on operations in the County of Essex. The capital is \$100,000 in shares of \$10.00 each. The applicants are:—Mary Agnes Burke, Windsor, John McArdle, of the same place, telegraph operator; John Atkinson Smith, of the same place, dentist; Charles Hilaire Deslisle, of the same place, hotel keeper, and William Goodwin Wood, of the same place, assayer.

The said John McArdle, John Atkinson Smith, and Charles Hilaire Deslisle are to be the first directors of the company.

We understand that the proprietors are at present negotiating for a sale of the well known Frontenac lead mine near Kingston. The property comprises the south half of lot 16 and the east and north parts of lot 15 in the 9th concession of Loughborough, containing about 200 acres, transversed diagonally for a distance of nearly a mile from south-east to north-west by the principal lead bearing vein, 10 to 12 feet wide, richly charged with galena, and cutting the country rock at right angles. On this vein two shafts have been sunk about half a mile apart. The eastern shaft, or No. 1, on lot 16, has been sunk nearly 200 feet, with an adit of 450 feet at a depth of 40 feet and 18 and 28 fathom levels along the vein and between its walls. The western shaft, or No. 2, on lot 15, has been sunk to about 30 feet, and the last ore raised from the bottom was a cubical mass of almost pure galena of about 200 pounds weight. This shaft is provided with a steam engine and hoist. At and near shaft No. 1 the following buildings have been erected:—(1) Shaft house. (2.) Dry house. (3.) Offices. (4.) Engine and crusher house, 82x44, with powerful engine and crusher. (5.) Dwelling house, 36x26. (6.) Boarding house, 48x21. (7.) Blacksmith's and carpenter's shop, 31x25. (8.) Barn, 36x24. (9.) Mill building, 66x60 and two storeys high, containing under one roof engine of 40 horse power, with two boilers, very complete pumping and hoisting machinery, drum, cables, &c., two sets crushing rolls, two sets jiggers, and other washing and dressing plant, Mackenzie blower, and American smelting furnaces. Lead to the value of \$25,000 was obtained from the mine by the late lessees. Mine and works have been carefully examined, and are very favorably reported upon by several of the best known experts in the country, including Prof. E. J. Chapman, Dr. Sterry Hunt, Dr. Robert Bell, and Sir J. W. Dawson. The largest interest in the property is now held, we believe, by Messrs. J. M. Machar and W. Romanes, Kingston.

Sudbury District.

Three car loads of machinery arrived at the Copper Cliff mine last week, where a second furnace is being put in by the company. They are down over 400 feet in the mine now, and on the second and third levels they found two immense pockets or domes, holding thousands of tons of ore—three parts copper and one part nickel.

The Simpson Bros. are still testing their 900 acre claim just east of Nickel City. They have found gold in seven different places on it, and have a crusher at work grinding out the rock taken from the test shafts. An old horse and a primitive apparatus, the same as that used in King Solomon's mines, makes about \$10 a day at it.

The new management of the Vermillion mine are preparing to work this magnificent property on a large scale. The great hill of decomposed ore on it is going to be tested with a diamond drill. It is estimated by mining experts that there are over a million tons of ore on this location alone, carrying from \$50 upwards of gold and platinum to the ton, besides enough silver to more than pay for working it. The silver in it averages \$11 to the ton.—*P. A. Herald.*

Port Arthur District.

A cablegram dated "London, England," states that "The bargain for the sale of the West Beaver mine has been closed."

Work is proceeding quietly at the Ottawa mine location. The ore is good and the prospects are that a large amount of money will be expended on the immediate development of the property. Leaf silver is being obtained.

The western shaft at Silber Mountain East is down about 400 feet and the silver is still found in abundance. A large shipment will be made in a few days to Great Britain. They are now taking out high grade ore every day, and on the whole the mine is looking well. If a railway were in operation the management would at once increase their force.

The following report has been received from Mr. Walpole Roland, C. and M. E., consulting engineer of the Silver Wolverine Co., (limited), dated Port Arthur, May 22nd: "Since date of my last report, referring to the rich strike of native and black silver in No. 1 shaft, at a depth of 82 feet and 90 feet, I have been unable to resume operations in this shaft owing to water. I have now, however, effected a purchase of hoist from the Beaver Mining Company that will fully answer our purposes. Immediately No. 1 shaft is made ready for further sinking, and the 100 feet level attained, we commence drifting from that point towards No. 2, between which points I anticipate cutting a rich deposit of black and native silver. In sinking No. 2 shaft, at a point 300 feet eastward of No. 1, after excavating some 13 feet of boulder drift and gravelly clay loam, they struck the vein. At this point the vein measures 4 feet 4 inches in width and carries the usual rich black blendes, fluorite and calcite together, with black silver and iron pyrites, and notwithstanding the fact that it is yet in the trap overflow.

The chief items of interest are the voting on the railway bonus by-law, on the 10th inst., at Port Arthur, as on it depends the immediate construction of the first fifty miles of railway into the silver and iron region south-west of Port Arthur.

In spite of the usual cry of boodle and the unpopularity of some of the Charter sellers, it is expected that the by-law will carry by a handsome majority. The Board of Trade and town Council are almost unanimously in favor of the scheme.

Mining locations are being sought after and bought up in view of the railway facilities. A large and enthusiastic meeting in the town hall, Port Arthur, was held last evening.

American tourists are doing the mines and the fishing in this vicinity in considerable numbers.

There has been nothing of special note to refer to in connection with the various silver mines. Favorable reports are daily received from the Badger, Beaver, Elgin, Silver Mountain, West End, Shuniah Weachu and Silver Fox mines.

The valuable buildings at the Jackfish or Huronian gold mines have been burned by bush fires. Nothing further will likely be done here until the Government road is completed to this property.

British Columbia.

The shipment of Texada iron ore amounted to 1,530 tons.

Shipping from the new Union Collieries has commenced. The latest reports speak most favorably of the several seams being opened. The principal seam being worked is now four feet of good merchantable coal, and as work progresses the thickness increases. The management are doing a good deal of prospecting on the property, two parties being at present working, one on Coal Creek and the other at Puntledge Lake. Three-foot seams have been struck on the latter, and thirty feet above an 18-inch seam. On Coal Creek, at the head of Allen Lake, a four-foot seam has been located, and a tunnel run in 200 feet. Above Allen Lake still another three-foot seam has been discovered. In fact the whole surrounding country seems to be one vast coal bed, and development will only prove that there is an inexhaustible area of the finest bituminous coal on the continent. The coal is said to be from 15 to 20 per cent. better steaming coal than the Wellington, weighs more per cubic foot (82½ pounds), though it does not ignite so rapidly. Up to 1st June it is estimated that at least half a million dollars have been expended on the property and in the provision of shipping facilities. The pay roll for May was over \$22,000.

The work of sinking the shaft at the North Field Mine of the new Vancouver Company, says the *Nanaimo Free Press*, is progressing most satisfactorily under the personal supervision of Mr. Robert Scott, the contractor. The shaft is now down over 300 feet, with about another 100 feet to reach the main seam of coal. With ordinary luck Mr. Scott expects to reach the coal in August. In the meantime, Mr. Samuel M. Robins, superintendent of the company, is perfecting arrangements for the rapid construction of the line of railway to Departure Bay and the loading wharves at Harwood Point and opposite the old Newcastle mine. As the majority of our readers are aware, this shaft is situated about four miles from the city and near the Wellington road and E. and N. Railway track, with the prospective Nanaimo Powder Factory in the near vicinity.

Work will be immediately resumed at the Monarch mine at Field, the owners of that property and the smelter at Vancouver having placed both mines and smelter in charge of L. D. Davis. This means business, for Mr. Davis is a thoroughly practical man. A number of men are working on claims adjacent to the Monarch, and Field is again showing signs of liveliness.

Reports are in circulation of rich placer finds on the headwaters of Bull River and over near Enderby. In fact, there is quite a stampede to the latter diggings, they being reported to be worth \$30 a day to the man.

On Porcupine Creek, the Discovery Company is making more than wages, and the Elsie taking out nuggets of as high value as \$15. The foreman of the latter is beginning to have a better opinion of the Elsie ground. The Donald Company has had some trouble with water in sinking a shaft, but now have it under control, and the shaft is going down at the rate of four feet a day. The French Company has everything in readiness, as soon as a pump arrives from Victoria, to begin pumping the water from its shaft, which is down over 35 feet.

A number of prospectors who left Donald intending to take in the country between the headquarters of Quartz creek and the north fork of the Spilimichene were turned back by the forest fires which are raging over in that section. They will make another effort by going in by way of the new McMurdo trail.

Coal Mining in Nova Scotia.

(Continued from June issue.)

work, and its strength and durability recommend it for mines having extended and irregular air ways. The Capel fan, which is highly spoken of, has not yet been introduced here.

The seams of the Cumberland and Cape Breton districts are very free from gas, it having been met in appreciable amounts only in the Springhill, Sydney and Caledonia collieries.

Still, reasonable care in systematically carrying the air through the workings is needed to prevent dangerous accumulations. Paradoxical as it may seem, mines giving off a small but steady amount of fire damp require constant watchfulness on the manager's part, as the employees do not bear in mind that their enemy, although easily routed, seldom omits to avail himself of any forgetfulness. Open lights and powder are used in all these mines.

In the Pictou district the seams are decidedly fiery, and much care is given to ventilation. They are as far as possible divided into separate districts for ventilating purposes, and in all, safety lamps are more or less used, and the use of gunpowder either guarded by appointing men to fire the shots, or in special cases prohibited.

TABLE SHOWING PRINCIPAL MECHANICAL VENTILATORS.
ENGINE AND FAN.

Colliery.	Name of Fan.	No. of cylinders.	Diam. of cyls., inches.	Length of stroke, inches.	Width of Fan, feet.	Diam. of Fan, ft.	Av. cubic feet.	Revol. per min.	Pr. of Steam, lbs.
Pictou Co.	Guibal	1	16	20	7	20	85,000	52	70
Intercolonial	Guibal	1	20	24	8	24	54,000	55	105
Acadia	Guibal	1	24	24	10	30	42,000	90	90
Vale	Guibal	1	12	24	10	16	20,000	85	85
Do.	Blowdown	1	12	24	10	30	80,000	39	45
Albion	Guibal	1	8	12	5.5	2.75	15,000	70	70
Nova Scotia	Sturtevant	1	12	36	7.5	18	41,000	35	55
Cumberland Co.	Blowdown	1	12	36	7.5	18	41,000	35	55
Springhill	Do	1	12	36	8	20	42,000	35	60
Do	Do	1	14	30	8	20	41,000	35	70
Cape Breton.	Guibal	1	24	24	10	30	67,000	40	35
Sydney	Champion	1	8	17	4	59	40,000	65	35 geared 34 to 1

PUMPING.

The seams of the various districts may be considered as not carrying large amounts of water. In the Springhill district three seams, lying close together, are worked with a steady extraction of pillars, under a roof carrying several beds of porous sandstone, and a heavy surface cover, and these conditions cause a heavy pump charge.

In the Pictou district the overlying measures are shaley and compact and pass little water, and at a depth exceeding 700 feet the workings are dry and dusty. In Cape Breton nearly all the mines are above the dry zone, but they are not very wet. In the Sydney mine workings there

is little water, the submarine workings being remarkably dry. At this colliery a large amount of water from the old workings has to be handled. The pump is a direct acting Cornish one, the dimensions being given in the table of Cape Breton pumps, working through two lifts, the low set 335 feet, the staple set 350 feet, total lift of water to delivery drift from pump being 668 feet. The same was noticed in the "Lingan" submarine workings. Under the Mines Regulation Act, submarine seams having a cover of less than 500 feet must be worked in panels, and approaches cannot be driven under a cover less than 100 feet thick.

At several of the Cape Breton mines the pit waters are decidedly acid, and necessitate phosphor bronze and other patent linings, etc., for the working parts of the pumps.

At the Gowrie mines, Mr. Chas. Archibald has had much trouble in countending against corrosive effects of the pit water. The pumping shaft is 200 feet deep, and is divided into two bucket lifts. It was found necessary to use babbitt metal lining for the working barrels, and iron and brass and gun metal shells, falis, etc.

As the water grew more acid from running over the small coal and stone in the bords, as the workings extended, it was found that pump rods, pumps, nuts, etc., were very quickly eroded. Finally wood pumps were used, and the straps, clamps, flanges, etc., protected by layers of tarred flannel. Similar precautions were taken with the rods, and finally the bucket doors and clack pieces were made of wood instead of iron. Mr. Archibald gave an interesting account of this matter in the Transactions of the North of England Mining Institute. The writer published some years ago a paper on the Nova Scotia pit waters, from which he gives the following analysis as serving to show the composition of some of these acid waters.

Block House mine, Cow Bay; Analyst, Geo. Suv. Canada, 1872-73. Suspended matter.

Sulphate of iron 1510

In solution.

Iron (as per salt) 2426

Iron (as proto salt) 1168

Manganese 0078

Aluminum 0420

Calcium 1498

Magnesium 0618

Potassium 0134

Sodium 1884

Silica 0116

Sulphuric Acid 14808

Chloric Acid 4100

Phosphoric Acid traces

Organic matter 2844

Total in 1,000 parts 3.0094

Water, yellowish brown color, acid reaction, and Styptic taste. *Gardener Colly, Bridgeport.

Iron Sulphate 2750

Potassium sulphate 185

Calcium Carbonate 736

Magnesium Carbonate 025

Sodium Chloride 096

Alumina trace

Silica 225

Total in 1,000 parts. ... 4.881

Water, clear with blueish shade, after standing, deposited reddish sediment, acid reaction and highly styptic taste.

The appended table will show that direct acting pumps are at present the most fashionable, especially those of the Cameron and Knowles pattern.

* Analyst, E. Gilpin, Jr.

DETAILS OF PUMPING APPLIANCES, CAPE BRETON.

COLLIERIES.	Number of Pumps.	Name and Style of Pump.	Steam Cylinder diam. inch.	Water Plunger diam. inch.	Length of Stroke.	Strokes per Minute.	Length of Waterpipe.	Length of Steam Pipe.	Steam Pressure at Bank.	Steam Pressure at Pump.	Vertical Lift.	Gallons Water per day.	Tons of Coal raised during 1886.
Sydney Mines (Queen)	1	Made to order.	30	8	48 in.	17	360 ft.	430 ft.	27 lbs.	.....	360 ft.	172,620	139,646
do (Princess Pit)	2	do	62	20	84 "	4½	720 "	.....	40 "	.....	720 "	139,863	
Victoria	1	Elliott.	18	7	44 "	14	590 "	890 "	40 "	37 lbs.	305 "	142,380	50,156
International	1	Knowles.	24	8	44 "	30	2100 "	2550 "	45 "	33 "	195 "	64,000	118,129
do .....	.....	do	12	5	12 "	60	3547 "	1592 "	45 "	20 "	185 "	115,984	
Reserve	2	do	12	7	24 "	60	.....	2080 "	50 "	35 "	.....	12,450	81,783
do .....	.....	do	14	9	18 "	50	3037 "	1486 "	50 "	35 "	283 "	.....	72,810
Caledonia (two sets)	2	Lifting.	.....	8	48 "	12	128 "	.....	30 "	.....	123 "	86,400	
do .....	.....	do	.....	8	48 "	12	60 "	.....	30 "	.....	60 "	.....	33,382
Little Glace Bay	3	Cameron.	8	8	30 "	40	310 "	340 "	.....	.....	260 "	205,834	
do .....	.....	Lifting.	6	6	48 "	10	255 "	.....	.....	.....	255 "	.....	95,307
do .....	.....	do	6	6	48 "	10	255 "	.....	.....	.....	255 "	.....
Gowrie	3	Knowles special.	20	10	48 "	20	254 "	244 "	43 "	35 "	215 "	328,265	.....
do Lifting .....	.....	Built to order.	.....	10	36 "	36	110 "	.....	.....	.....	110 "	.....
do do .....	.....	do	.....	10	36 "	36	110 "	.....	.....	.....	110 "	.....	.....

1886. DETAILS OF PUMPING APPLIANCES, PICTOU AND CUMBERLAND.

Company.	Appliances.		Length of Stroke.	Diameter Steam Cylinder.	Diameter Water Cylinder.	Number Strokes per minute.	Steam Pressure at Boiler.	Distance of pump from boiler in ft.	Steam Pressure at Pump.	Vertical Height of Discharge.	Pressure of Head per sq. in. lbs.	Length Steam Pipe.	Length Water Pipe.	Diameter Water Pipes.	Diameter Steam Pipes.	Average gallon discharge per day approximately.		Tons of Water raised year 1886. (Estimated)	Tons of Coal raised during year 1886.	Remarks.	
INTERNATIONAL COAL COMPANY, Westville. Connected.	Top.	Cameron Pump No. 8.	36 in.	18 in.	8 in.	20 to 40	lbs. 80	480	79½	350	lbs. 208	800	.....	.....	5 in.	60,000	.....	104,500	108,498	Pipes covered with composition made by Mechanical Engineer
	Mid.	No. 3.5.	12 "	10 "	4 "	40 to 60		1380	77½	300	130	900	900	3 × 2½	2 × 2½		.....	.....	
	Bot.	No. 3.4.	12 "	7 "	3½ "	40 to 60		1780	75	113	49	400	400	2 in.	2 in.		.....	.....	
ACADIA COAL CO. Westville.	Duplex Compound Pump.		24 "	H. P. 12 " L. P. 22 "	5½ "	45	105 lbs	2600	95	996	433	2600	2400	6 in.	4 in.	108,000 per day of 24 hrs.	.....	167,000	93,891	Pipes covered composition clay & straw
JOGGINS.	Burling and Johnson's Pump.		40 "	20 "	8½ "	15	60 "	1500	38	205	80	1500	600	8 in.	4 in.	84,000	.....	153,300	22,243	Pipes not covered.
VALE COLLIERY.	6 ft. Steam.	Cameron Pump.	24 "	15 "	5 "	50	80 "	1240	70	365	159	1240	1040	.....	.....	144,000	.....	262,800	128,539	Pipes covered to pit head. Balance of pipes in mine exposed.
		Blake Pump.	12 "	8 "	5 "	60	.....	510	.....	130	57	510	310	.....	.....	8,640	.....			
		Knowles. Bot.	30 "	30 "	8 "	25	70 "	1400	60	650	282	1400	1200	.....	6 in.	234,000	Disch'rgs to mid. pump.			
	McBean Seam. Connected.	Cameron. Top.	30 "	20 "	6 "	50	.....	500	.....	238	103	500	500	.....	4 in.	252,000	Disch'rgs at surface.	459,500	416,739	Cover'd from boiler to pit mouth with infusorial earth.
		Top Allison Pump	6 ft.	30 in.	14¼ in.	15	75 "	750	68	340	148	750	750	12 in.	9 "	1,080,000	Disch'rgs at surface.	1976,000			
SPRING HILL MINES.	West Slope. Connected.	Bottom Allison Pump	.....	.....	.....	.....	.....	1430	55	310	134	680	680	12 "	6 "	1,080,000	Disch'rgs to top pump.	.....	416,739	Cover'd from boiler to pit mouth with infusorial earth.
		Special Blake	3 ft.	28 "	11½ in.	32	60 "	512	40	430	187	890	850	8 "	4 "	742,080	.....	1354,296		
	Cameron Pump. Connected.	Blake, not used.	416,739	Cover'd from boiler to pit mouth with infusorial earth.
		Special, No. 7	30 in.	22 "	9 in.	40	60 "	.....	40	.....	.....	.....	.....	.....	.....	460,200	.....	840,960		
		No. 5.	24 "	15 "	7 "	50	85 "	1500	60	278	121	1500	1400	4 "	3 "	216,000	.....	394,200		
ALBION COLLIERY	Foord Pit.	No. 2.	18 "	10 "	4 "	65	85 "	1800	50	32	14	300	300	2 "	2 "	86,400	Disch'rgs to top pump.	.....	1599,758	.....
				

From these tables it appears that in the year 1885, 1,352,205 tons of coal were raised, and that during the same period 3,646,889 tons of water were pumped—or nearly three to one. This estimate of the relative amounts of coal and water extracted has seldom been made over so large a district, and is interesting for reference beside the enormous tonnage of water to ore in many metal mines. It should, however, be remembered in considering these results that much of the water is from old workings, and forms a permanent duty. At the Sydney mines the present workings make little water, and the pumps have to handle the seepage of the acreage resulting from a century of mining and pillar working. At the Albion Colliery the pump duty represents in a similar manner the water of the underlying seam, as well as of the old workings in the thick coal which broke the roof

for many feet. Here the main shaft of the workings furthest from the dip has been selected for pumping. The work is performed by substituting for the two cages, two tanks each 8 ft. 6 ins. by 3 ft. 3 ins. by 5 ft., which automatically open on entering the water, and by engaging with a lever at the top of the shaft discharge without any attention. The tanks are raised and lowered by the winding engine at an average rate of 600 trips per day of 20 hours, which is equivalent to about 520,000 gals.

The pump at the Acadia Colliery is one of the best in use in our coal mines. The lift is one of the heaviest single lifts in America, and the following note will be of interest.

The mine is opened by a slope 2400 feet long, vertical depth 1000 feet. The pump is a Knowles of the duplex compound condensing type, with high and low pressure cylinders, 12 and 22 in.

in diameter, 24 in. stroke with four $5\frac{1}{2}$ inch plungers working against a head of 435 lbs. per square inch. The column is six inches in diameter, of wrought iron, the air chamber is 30 by 15 inches, the steam pipe 2600 feet long and four inches in diameter, takes the steam from Babcock boilers on the surface, at a pressure of 105 pounds. The pipe is protected with an insular earth jacket, the material being taken from a local deposit. After four years service this pump has given no trouble, and no joints have leaked. There is no suction on the pump, the lower valves being below the level of the water. The pump usually makes 10 double strokes a minute, but could run 25 strokes, equal to 100 feet piston speed a minute. A small hydraulic ram will raise the water from the lower level to the pump.

PARTICULARS OF WINDING ENGINES, NOVA SCOTIA COAL MINES.

COLLIERY.	Nos. of Cylinders.	Dia. of Cylinders, inches.	Length of stroke, in.	No. of Drum brls.	Dia. of Drum barrels, feet.	Weight of load, cwt.	Diam. of rope, inches.	Length of haul, in ft.	Pressure of steam, lbs.	
Pictou Co.										
Intercolonial Colliery, { Slope	2	16	36	2	8	126	1	1,800	70	Geared, 2 to 1; dip 15°
Underground	2	16	28	2	8	126	1	1,200	70	do 3 to 1; do
Acadia Colliery (Slope)	2	16	42	1	9	*100	1½	3,100	85	Geared, 3½ to 1; dip 27°
Vale Colliery, { McBean Slope	2	32	60	1	14	120	1½	2,400	55	Direct; dip 35° R.F.E.N.
Six feet do	2	16	36	2	10	†80	1	1,800	60	Geared, 3 to 1; dip 23°
Albion Colliery (McGregor Pit)	1	24	72	2	—	†80	4 ×	1,800	45	Flat ropes, direct acting.
Cumberland Co.										
Springhill Colliery, { West Slope	2	20	36	1	9	100	1¼	1,300	55	Geared, 3 to 1; dip 25°
North Slope	2	15	30	1	9	120	1¼	800	60	do
East Slope	2	16	36	1	9	60	1½	800	70	do
Joggins Colliery (Slope)	2	18	36	1	9	60	1	1,350	75	
Cape Breton Co.										
Sydney Colliery, { Pit	2	36	60	1	18	132	1¾	660	40	Direct acting.
Underground	2	16	36	2	4	792	¾	5,400	40	Gross lead, geared 2¾ to 1.
do	2	16	24	2	4	252	¾	5,800	40	Gross load, geared 1¾ to 1.
Victoria (Slope)	2	22	54	2	6	152	1	1,959	50	Direct, dip 15°
International Colliery, { Pit	2	16	40	1	7	39	1½	100	40	Geared, 2 to 1.
Underground	1	12	20	2	3 × 3½	224	¾	2,100	40	Stands at Bank, dip 2½. Geared, 3 to 1.
Caledonia (Pit)	2	11	24	2	6	49	3½ × ¾	205	50	Geared, 4 to 1.
Glace Bay (Pit)	2	12	36	1	6½	58	1¼	245	47	Geared, 2½ to 1.
Gowrie, { Pit	2	20	42	1	8	49	13-16	235	60	Direct.
Underground	2	10	12	1	4¾	192	¾	1,000	45	Geared, 5 to 1; dip 8°
Reserve, { French	2	20	54	2	4	256	¾	2,754	50	do 2 to 1; dip 5° 20'
Slope						256				Twin engine at main slope.

* Wt. of coal, tubs, ropes, etc., 200 cwt; add 5 p.c. for friction; total, 210 cwt.

† Coal only.

‡ Gross weight.

§ Net load.

Expansion in the steam pipes is guarded against by U pieces. The pump stands in a house lined with brick, and having a cement floor.

The appended table shows the winding engines at the principal collieries, above and below ground. They are generally direct acting for shaft work and geared 3 to 1 for drawing through slopes. As fuel forms a small item in the expense of raising coal, low pressure and simple engines are in use. The economy is more apparent than real, and compound engines with the lessened wear and tear of boilers would prove more satisfactory. The speed in the shafts is low owing to their comparative shallowness. In the slopes the speed is practically limited by the rate at which the empty tubs can run safely down the incline.

At many of the deeper slopes the men are raised in long tubs, holding from one to two dozen, with extra couplings, and a trip bar, or "durkey" at the end of the last tub.

At the Intercolonial colliery the coals are drawn up the slopes, dipping at an angle of 15°, 1,800 feet long, the gross weight being 11,400 lbs. in the space of 1 minute and 50 seconds, and the empty tubs are lowered by brake in one minute.

The tubs hold from one-half to one and a quarter tons of coal. The wheels are made with fast or loose axles, and vary in diameter from 10 to 12 inches. The gauge of the tracks is from 2 ft. to 2 ft. 8 in.

The following table will show the tubs used at the principal mines:—

A TABLE of the dimensions of pit tubs in use at the principal collieries:

NAME.	Track Gauge.	Dia. of Wheels.	Wheel Base.	Height above track.	Width.	Length.	Height.	Capacity.
Joggins	30	12	20	37	37	48	23	23.6
Acadia	28	11	22	31	42	60	24	35.
Albion Mines ..	26	12	18	42	33	44	28	23.5
Intercolonial ..	32½	14	20	42½	26	50	28	21.
Caledonia	24	11	22	38	33	94	24	35.5
Glace Bay	30	10	16	36	33	60	24	17.5
Gowrie	24	12	18	38	34	80	24	19.0
International ..	32	14	18	45	30	49	29	24.6
Reserve	26	11	20	43	32	44	30	24.4
Sydney	24	11	26	40	34	37	27	19.6
Vale 8 ft. seam.	29	10	....	45	33	54	25	26.8
" 6 ft. seam ..	29	12	....	42	33	54	25	25.7

Boilers.—In Cape Breton the boilers used for supplying steam to the pumps and winding engines are generally plain egg ended and cylindrical. Their dimensions vary in length from 20 to 37 feet, in diameter from 3 to $5\frac{1}{2}$ feet. The working pressure varies from 30 to 50 lbs.

In Pictou and Cumberland there is a greater variety seen. At the Acadia colliery four Babcock boilers, running at a pressure of 105 lbs., supply the fan and underground engine and pump.

At the Vale colliery Lancashire and tubular boilers are used. At the West Slope, Springhill collieries, two Galloway boilers, 7 by 30 ft., form part of the battery. At several mines the plain egg ended boilers are used with pressures varying from 30 to 55 lbs. The consumption of coal, part round and part slack, used for stationary and locomotive engines, during the year 1887, was about 139,777 tons.

Transportation.—The various collieries are provided with railways varying in length from one half to thirty-seven miles for shipment of coal. The longest line in operation is that of the Cumberland Railway and Coal Company, who carry coal four miles to the Intercolonial Railway and thirty-three to Parrsboro on the

Bay of Fundy. The latter line is at present operated principally for general passenger and freight business, but it is expected that when their shipping facilities are completed much of their coal will find an outlet to St. John, New Brunswick, and the United States, via Parrsboro. The same company are now building towards the Gulf of St. Lawrence to obtain an outlet at Pugwash, so that they can secure water transportation to Quebec and Montreal during the summer months. A branch line ten miles long from Macan, on the Intercolonial Railway to the Joggins shore runs along part of the outcrop of the northern edge of the Cumberland coal field. It has been opened this year, and promises to develop several valuable coal seams.

The Pictou collieries are connected with shipping piers in Pictou harbor, and with the Intercolonial Railway by short branches which they operate with their own engines and cars, using the Government rolling stock when shipping over the Intercolonial road. In Cape Breton the Sydney mines ship at North Sydney, while the Victoria, International, Reserve and Bridgeport collieries ship at piers on the south side of the harbor. At Glace Bay, a brook emptying into the Atlantic, has been dredged into a spacious dock, capable of holding half a dozen large steamers and twice as many square rigged vessels. This dock was originally made through the enterprise of the Glace Bay Coal Company, but the Caledonia Coal Company have recently utilized it for shipping coal. At Cow Bay the Gowrie mine coal is shipped at a pier protected by the Government breakwater. The railway now being built through the Island of Cape Breton will, it is expected, be extended so as to connect all the principal mines with Sydney harbor, and ultimately to reach Louisburg harbor, so that during the summer, the busiest season, two outlets will be available, while the lessened winter trade can be accommodated at Louisburg. At present the cost of maintaining roads from one to eleven miles in length, with the rolling stock equal to a shipment of 2,000 tons a day, for summer shipments only, forms a heavy charge.

The various colliery roads and their equipments call for no special notice. The locomotives are of English and American types, the cars carry from four to six tons, and empty below. At the Sydney mines effective service is rendered by a locomotive built in the Company's shops, the frame, axles and tyres only being imported.

The locomotives vary in power and weight up to a Baldwin 50 ton freight engine. The roads are largely laid with steel rails, and are kept in very fair order. The only road calling for any special notice is that of the Sydney and Louisburg Coal Company. This road runs from Sydney to the Reserve mine a distance of eight miles, and ten miles further to the colliery at Schooner Pond, formerly operated by the company, and extends to Louisburg harbor, making in all 32 miles. At present the line is working only from Sydney to the Reserve colliery, the rest having been closed during the late depression in the coal trade. It is expected, should the trade continue to improve as it has for the past few years, that operations will be resumed on the Schooner Pond Branch, and the shipping piers at Louisburg be again utilized.

The road is well built and ballasted. Its gauge is three feet, with maximum grades of 1 in 100 against, and 1 in 75 with the traffic. The nature of the country has permitted a nearly a straight line with a minimum of curvature. In addition to two ordinary tank locomotives, it is equipped with three Fairlie double truck

locomotives, 25 tons loaded weight, with 11 inch cylinders, 19 inch stroke, and 3 feet 3 inch wheels. About forty trucks, holding four tons each, make a train.

These locomotives have done very good work, but it is a question if this pattern of engine on a narrow gauge road will prove as effective in winter as one of American pattern on the standard gauge, as they are not so handy in snow, and have very little clearance.

The wharves for coal shipments are all of wood, usually constructed with blocks and lines of piling. The cheapest form is that of a long pier with shoots on each side. In some cases a fall is given to a central track for the loaded cars to run towards the end of the pier, and are reverse grade for them to pass back to the shoots and return empty. In other wharves the loaded and empty cars are moved by horses. Where a level pier top is adopted, a system of ropes with hydraulic capstans would be found quicker and cheaper than horse-power.

The pier of the Sydney and Louisburg Railway, as described in the report of the Geological Survey, may be taken as a type of the most approved wharf. This structure, at the terminus of the railway in the town of Sydney, is a handsome and substantial structure, 620 feet in length, and 40 feet wide, with 36 feet of water at the end at high tide (the rise and fall being about 4 feet). The top of the pier standing 24 feet above high tide level is furnished with four tracks and seven loading shoots, and four traversing tables. The wharf is built upon very long and stout piles of Baltic timber, creosoted, and suitably braced by caps, ties and trusses. The superstructure is of native timber of good quality, and strongly framed. The cost of the wharf is given at about \$20,000.

The creosoting has proved an effectual preservation against the ravages of the teredo, and the piles, except a few imperfectly impregnated are in good condition at the end of fifteen years. The author is not aware of other applications of of chemically prepared timber for this purpose in Nova Scotian wharves. Reference has been made to the very acid water pumped from the Gowrie colliery. This water runs into the sea alongside their shipping pier, and, it is said, exercises a very decided effect in preventing damage from the naval borers, etc.

(To be continued.)

Interesting Electric Pumping Plant at a Scotch Quarry.—There is now at work near Linlithgow, Scotland, an electrical installation for pumping water which has some very interesting features. The motor and pump are situated at Kingscavil Quarry, near Linlithgow, where they raise water to a reservoir at a height of 135 feet, the water being forced through a distance of 600 yards of two inch pipes. The quantity of water raised has not been stated, but the pumps are double acting plungers at 2½ inches diameter, designed to work at about 40 revolutions to the minute. The dynamo is situated in the engine room of the Linlithgow Oil Co., at a distance of fully a mile and a quarter from the quarry, so that the power is transmitted electrically over 4,000 yards of cable. This not being an underground case, the cables are naked and are carried by insulators on telegraph poles. The E. M. F. at the dynamo terminus is 250 to 300 volts, and the current 11 to 12 amperes, the output being thus about 3,000 Watts, or about 4 h. p., and a

margin of 30 to 40 per cent. over present requirements has been allowed for future use. This is a small installation, but will serve as a demonstration of what can be accomplished. It works satisfactorily, and requires no attendant at the pumping house at the gangway.

Canadian Mines on the English Market.

	Price Per Share.
General Mining, Limited £219,752 fully-paid shares of £8 4½	4½
Low Point, Barrasois and Lingan, \$309,100 fully-paid shares of \$100.....	—
Ditto, \$200,000 vendors fully-paid shares of \$100.....	—
North Western Coal and Navigation, Limited, £160,500 6 per cent. debentures; coupons June 30 and Dec. 31; principal 1904.....	—
Ditto £149,500 fully-paid ordinary shares of £10.....	—
Ditto £900 fully-paid deferred shares of £100.....	—
Sydney and Louisburg Coal and Railway, Limited, £50,000 cumulative 10 per cent. first preference shares of £10, £6 paid.....	7½ 8½
Ditto, £14,560 fully-paid non cumulative 6 per cent. second pref. of £10.....	3 5
Ditto, £250,000 fully-paid ordinary shares of £10.....	1 2
New Vancouver Coal Mining and Land Co., Limited, £185,000 fully-paid shares of £1.....	—
Excelsior Copper, Limited, fully-paid shares of £1.....	—
Ditto, shares of £1, 17s. 6d. paid.....	—
Shuniah Weachu, Limited, £99,888 fully-paid shares of £1	—
Silver Wolverine, Ltd., £68,465 fully-paid shares of £1.....	—
Anglo-Canadian Asbestos, Limited, £39,132 fully-paid shares of £2.....	—
Anglo-Canadian Phosphate, Limited, £46,340 fully-paid pref. shares of £10.....	—
Ditto, £15,050 fully-paid deferred shares of £10.....	—
British Columbia Smelting, Ltd., £25,000 preference shares of £1, 10s. pd.....	—
Ditto £40,000 fully-paid ordinary shares of £1.....	—
Canadian Phosphate, Ltd., £100,000 fully paid shares of £1.....	¾ 1
Bell's Asbestos, Limited, £100,000 fully paid shares of £5.....	16½ 17½
White's Asbestos, Limited, £20,000 fully paid shares of £1.....	—
Ditto shares £1 paid.....	—
Jackson Rae Phosphate Co., Limited, £25,000 fully paid shares of £1.....	—

General Mining.—Accounts to December 31 submitted in April, but an interim meeting is held in November. Dividend for 1884, 5 per cent; for 1885 and 1886, 3½ each year; and for 1887, £4 13s. 9d. per cent. Reserve fund, £20,850.

Low Point.—The vendors' shares, up to the end of 1888, do not rank for dividend until 7 per cent. per annum dividends have been paid on ordinary. Accounts to Dec. 31. For 1887, 5 per cent. was paid on the ordinary shares other than those held by the General Mining Assoc., that Company foregoing their dividend rights.

North Western Coal.—The deferred shares receive on dividend until 15 per cent. per annum (cumulative) has been paid on the ordinary. Accounts to June 30. Dividend for 1887-8, 5 per cent.

Sydney and Louisburg Coal.—Accounts to Dec. 31 submitted about May. Out of the profits of 1884 one half-year's dividend on the first preference shares was paid. No dividend since. Debit to Dec. 31, 1887, £1,574.

Vancouver Coal.—Accounts to June 30 and December 31 submitted in November and May. In the half-year to June, 1888, there was a net profit of nearly £11,000. Debentures, £57,200. Reconstruction has been decided on.

Excelsior Copper.—Registered September 26, 1888. Authorized capital, £450,000; purchase consideration, £400,000, in cash or shares. Fully-paid shares issued to the vendor; partly paid to the public.

Shuniah Weachu.—Accounts to Nov. 20 submitted in February. No dividend yet.

Silver Wolverine.—Registered October 19, 1888, with a capital of £100,000, of which £80,000 was the first issue. Most of the shares were issued to the vendor.

Anglo-Canadian Asbestos.—The Company was registered in November, 1885. Accounts to October 31 submitted in March. No dividend yet. Debentures, £3,450. Reports are not obtainable, but this information is official.

Anglo-Canadian Phosphate.—The preference shares rank first for 7 per cent., and after a like rate has been paid on the deferred shares, both classes rank equally.

British Columbia Smelting.—The company was registered May 9, 1888. The ordinary shares were issued to the vendor, and they do not rank for dividend until the preference shares have received dividends amounting to 100 per cent.

Canadian Phosphate.—Accounts to November 30 submitted in February. Eleven months to Nov. 30, 1888, resulted in a profit of £2,576, which was carried forward.

White's Asbestos.—Registered April 9th, 1889. The authorized capital is £100,000; first issue, £60,000, of which £20,000, fully paid, was issued to the vendor.

Manitoba and North-West Territories.

Notice of application for incorporation under the provisions of the Companies Act is made by The Anthracite and Bituminous Coal Company, Limited. The chief place of business of this new concern will be at Toronto. The capital stock will be \$250,000 in shares of \$100 each. The applicants are: B. E. Chaffey, Winnipeg, barrister-at-law; William Hamilton Merritt, Toronto, mining engineer; Frank A. Manning and Sanford Hall Fleming, Ottawa, civil engineers, and George F. Harman, Toronto, barrister-at-law, and who are to be the first or provisional directors of the said company.

A sample from the mine owned by the Cariboo Creek Mining Company was sent to the Selby Smelting & Lead Co. of San Francisco for a test. The return gave the value of the ore as \$18 in silver and \$32 in lead, the smelting company stating that it was worth \$27.20 a ton in San Francisco, but that it contained too much lead to enter the United States duty free.—*Truth.*

Experts have lately visited the Beaver and Queen mines, Port Arthur District, in order that the best of evidence may be had by the owners of those properties.



MONEY ORDERS.

MONEY ORDERS may be obtained at any Money Order Office in Canada, payable in the Dominion; also in the United States, the United Kingdom, France, Germany, Italy, Belgium, Switzerland, Sweden, Norway, Denmark, the Netherlands, India, the Australian Colonies, and other countries and British Colonies generally.

On Money Orders payable within Canada the commission is as follows:

If not exceeding \$4	2c.
Over \$4, not exceeding \$10	5c.
" 10, " "	20c.
" 20, " "	40c.
" 40, " "	60c.
" 60, " "	80c.
" 80, " "	100c.

On Money Orders payable abroad the commission is:

If not exceeding \$10	10c.
Over \$10, not exceeding \$20	20c.
" 20, " "	30c.
" 30, " "	40c.
" 40, " "	50c.

For further information see OFFICIAL POSTAL GUIDE.

Post Office Department, Ottawa.
15th Sept., 1888.

LEDOUX & COMPANY,

10 CEDAR ST., NEW YORK,

Engineers, Metallurgists & Assayers.

Public Ore Sampling & Storage Works

All the principal buyers of furnace materials in the world purchase and pay cash against our certificates of assay, through New York banks.

By special permission of the Secretary of the Treasury of the United States, cars of ore or copper matte passing through in bond can be opened and sampled at our works.

Consignments received and sold to highest bidder. Send for circular giving full particulars.

Mines examined and sampled. Assays and Analyses of all kinds.



NOTICE

Is hereby given that all communications in respect to matters affecting the Department of Indian Affairs should be addressed to the Honorable E. Dewdney as Superintendent General of Indian Affairs, and not as Minister of the Interior, or to the undersigned. All Officers of the Department should address their official letters to the undersigned.

L. VANKOUGHNET,
Deputy Superintendent-General
of Indian Affairs.

Department of Indian Affairs,
Ottawa, 15th May, 1889.



SEALED TENDERS addressed to the undersigned, and endorsed "Tender for Coal, Public Buildings," will be received until Friday, 2nd August next, for coal supply, for all or any of the Dominion Public Buildings.

Specifications, form of tender and all necessary information can be obtained at this Department on and after Tuesday, 9th July.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures.

Each tender must be accompanied by an accepted bank cheque made payable to the order of the Honorable the Minister of Public Works, equal to five per cent. of the amount of the tender, which will be forfeited if the party decline to enter into a contract when called upon so to do, or if he fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department will not be bound to accept the lowest or any tender.

By order.

A. GOBEIL,
Secretary.

Department of Public Works,
Ottawa, 3rd July, 1889.

CENTRAL CANADA FAIR,

UNDER THE AUSPICES OF THE

Central Canada Exhibition Association,

WILL BE HELD

AT OTTAWA,

—FROM—

9th to 14th SEPT., 1889.

PREMIUMS \$12,000 OFFERED

BESIDES MEDALS, ETC.

As will be seen from the Prize List now ready, special inducements are offered for exhibits of the

ECONOMIC MINERALS OF CANADA

UNDER THE FOLLOWING SECTIONS:

1. Metals and their Ores.
2. Mineral Manures.
3. Mineral Pigments.
4. Salt, Brines and Mineral Waters.
5. Materials applicable to Common and Decorative Construction
6. For the production of Light and Heat.
7. Refractory Materials.
8. Fine Arts and Jewellery.
9. Photographs, Maps, Plans, &c., of Mines, Workings Machinery, Buildings, &c.

A Medal will also be awarded for the

BEST COLLECTION and DISPLAY.

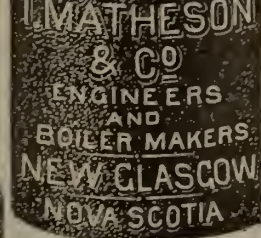
For Prize Lists, Programmes and other information apply to

C. MAGEE, PRESIDENT, R. C. W. MacCuaig, SECRETARY,
Ottawa.

SPECIAL MIXTURE USED

WRITE
FOR
PRICES

FOR SHOES & DIES



JAMES S. NOAD,
MINING AGENT

AND PROMOTER OF AND DEALER IN

Mines and Mining Properties,
MONTREAL, CANADA.

MINES AND MINING PROPERTIES.

The undersigned, representing a London Syndicate, is prepared to negotiate for desirable Mines and Mining Properties, for the purpose of forming them into Joint Stock Companies, or providing cash capital for their proper development.

Address or call on

JAMES S. NOAD,
Montreal.

JAMES S. NOAD,
MINING AGENT

AND PROMOTER OF AND DEALER IN

Mines and Mining Properties,
MONTREAL, CANADA.

CRUDE AND MANUFACTURED FOR ALL PURPOSES.



Cloths, Pacings, Furnace Cements, Paper, Stove Linings, &c.

SPECIALTIES: FIRE-FELT, a flexible Asbestos Sheet, made in tubular sections and rolls, best and most durable non-conductor made. SUPERATOR, a strong fire & waterproof fabric for sheathing & roofing buildings, fire proofing boiler rooms, &c.

THE CHALMERS-SPENCE CO.,

419 TO 425 EIGHTH ST., NEW YORK.

ASBESTOS.

POSITION WANTED.

A practical Certificated Colliery Manager is open for engagement. Twenty years experience in every system of Coal Mining in some of the largest collieries in the North of England and in Nova Scotia. Large experience in sinking and timbering shafts.

Address:

COLLIERY MANAGER,
Canadian Mining Review,
Ottawa, Ont.

FOR SALE.

Asbestos Mines.

On Lots 27, 28 and 29, in Range A, of Colrairie,
Megantic County, P. Q.

300 ACRES,

One Mile from Quebec Central Railway.
Free from Reserves or Royalties.

James Reed,
Reedsdale, Megantic, P. Q.

RUSSELL & CO.

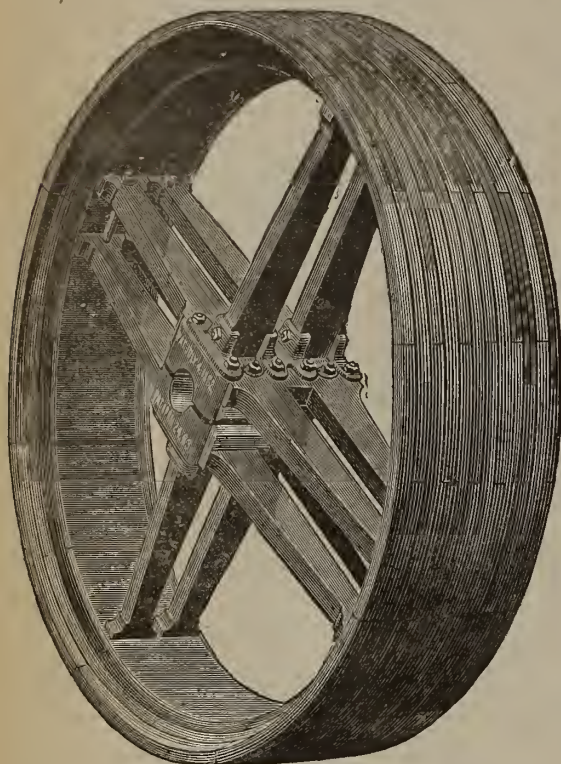
PROVINCIAL AND DOMINION

LAND SURVEYORS,
CIVIL AND MINING ENGINEERS,
PORT ARTHUR, ONTARIO.

Mining Properties Surveyed, Reported on and Dealt in.

Latest and Most Complete Plans of Thunder Bay
Mining District Always on Hand.

A. L. RUSSELL, A. H. MACDOUGLL, W. W. RUSSELL
P. L. S., D. L. S. P. L. S., D. L. S. M. E. A. M. C. A. S. O. C. C. F.



DODGE PATENT

Wood Separable Split Pulleys

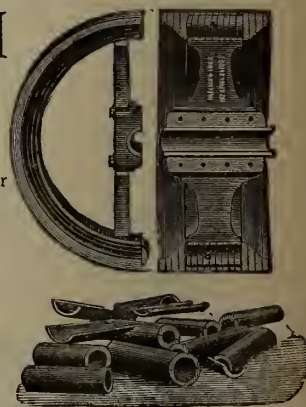
Best Belt Surface, Lightest, Strongest, Best Balanced and Most
Convenient Pulley in the World.

WITH OUR PATENT BUSHING SYSTEM

In Comparing Prices of Pulleys please note carefully the
following:

1. Our list is lower than most others.
2. Every Pulley is a Split Pulley.
3. Every Pulley is guaranteed to transmit from 25 to 60 per cent. more power than an iron one with same tension of belt.
4. Our Pulleys are 70 per cent. lighter than iron pulleys.
5. The fastening does not mar the shaft.
6. They are perfect in Balance.
7. They can be used on many different sizes of shafting.
8. They are the most thoroughly made wooden pulleys in the world.
9. And the handsomest pulley on the shaft.
10. No chances to take. Every pulley as represented or no sale.

Order a Sample Pulley, after which you will have no other.



EVERY PULLEY IS A SPLIT PULLEY
Made in any size from 9 inches to 16 ft. diameter
with original bores of 3 and 3½ inches,
bushings to be used for intermediate sizes;
larger ones bored to order.

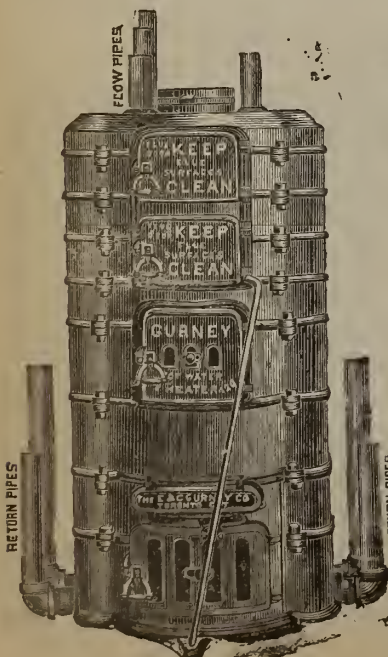
WE ALSO MANUFACTURE
WOODEN GROOVED PULLEYS FOR THE TRANSMISSION OF POWER
BY MANILLA ROPE,

Under the Dodge Patent System from 5 to 500 h. p. State power to be transmitted, speed of shafts, relative position of shafts, distance between shafts, and we can furnish a clear estimate.

EVERY PULLEY WILL FIT.

22 or more sizes of Shafting.
200 of our Pulleys and an assortment of bushings represent as many as 4,000 iron pulleys, a great advantage to dealers carrying stock.

Apply for particulars to **THE DODGE WOOD SPLIT PULLEY CO., TORONTO.**



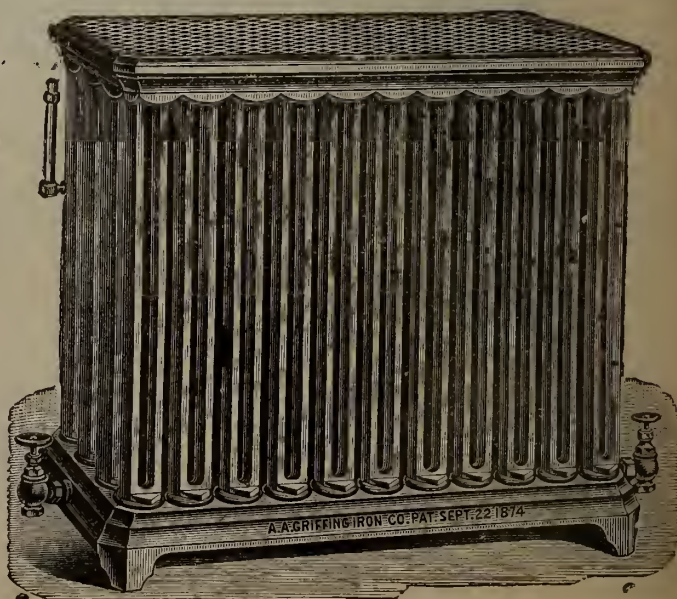
USE GURNEY'S IMPROVED CELEBRATED Hot Water Heaters!

Guaranteed more Economical than any other
Heater now made, and containing every
known Improvement in Hot
Water Heating.

STEAM FITTINGS, CAST IRON PIPE,
REGISTER, GRATES, ETC.

HOT AIR FURNACES
FOR COAL OR WOOD.

E. & C. GURNEY & CO.,
MONTREAL.



Bundy Radiators for Quick Circulation and Economy of Space.

VALUABLE PLUMBAGO

AND OTHER

Mineral Lands FOR SALE,

IN THE TOWNSHIP OF BUCK-
INGHAM, COUNTY OF
OTTAWA.

1st.—Lot 28, in the 6th range, containing 100 acres, in addition to the salina of the lake.

2nd.—North half of lot 23, in the 5th range, containing 100 acres.

3rd.—Nine acres of lot No. 28, in the 5th range, with water privileges thereto appertaining, being site of mill dam, etc., etc.

The property formerly belonged to the Montreal Plumbago Mining Company, and was worked successfully for several years, until the company's mill was destroyed by fire, but the mill dam remains almost uninjured, and there are on the property several houses, sheds, etc., built for various purposes when mining operations were carried out.

The Plumbago Deposits

upon the property are regarded as amongst the richest and most extensive in the Dominion. As to the quality of the Plumbago, it has been extensively used in the manufacture of crucibles, lubricating leads, stove polish, etc., etc., and given unbounded satisfaction. This is established by the experience of consumers, and by a certificate from the celebrated Battersea Crucible Works, London, England, a copy of which is open for inspection.

MICA

has also been discovered in quantity

The lands are in the Phosphate region, and recent prospecting has disclosed a rich and extensive deposit of this mineral. There are unrivalled facilities for transporting the ore to and from the mines by the Ottawa River and C. P. Railway. Distance from mines to Railway Station 6 miles. Good road.

All that is required to make these valuable mines handsomely remunerative is a little capital and enterprise.

The Title is Indisputable.

For information apply to

WM. H. DICKSON,
160 Waller St., Ottawa.

H. E. DICKSON,
Russell House, Ottawa.

OR TO THE OFFICE OF

THE CANADIAN MINING REVIEW.
OTTAWA.

SHIPMAN ENGINES, ACME MODEL. COAL OIL FOR FUEL.



To parties requiring a safe, reliable, durable and economical Steam Launch, from 20x4 to 35x7 with ample power to give satisfactory speed, we can supply the best on the market and at prices which will defy competition for a like quality of goods. We have a full staff of competent boat and engine builders and guarantee every article to be strictly first class. Hundreds of our engines from 1 to 12 h. p. Marine or Stationary have been in use for years and are acknowledged superior to all others. No smoke, dirt or sparks, no manual or mechanical labor necessary. You have the privacy of your launch for your family. As the water and oil supply is automatic very little attention is required. But a few minutes is necessary to get up 100 lbs. of steam; when you return to the boat house by turning a hand wheel all fire is extinguished. Orders for coming season should be placed at once, as the demand is much in excess of previous years. Write for 1889 circulars giving prices, testimonials, etc. No attention paid to postal cards.

JOHN GILLIES & CO., Carleton Place, Ont.



—FOR—

Mines, Elevators, Inclines, &c.

GALVANIZED GUY ROPE. BRIDGE CABLES.
HAWSER ROPES.

WIRE of all kinds. Insulated WIRES

John A. Roebling's Sons Co.

117 & 119 LIBERTY St., NEW YORK.

H. L. SHIPPY Sec'y.

PHOSPHATES, PHOSPHATIC MANURES, AGRICULTURAL FERTILIZERS

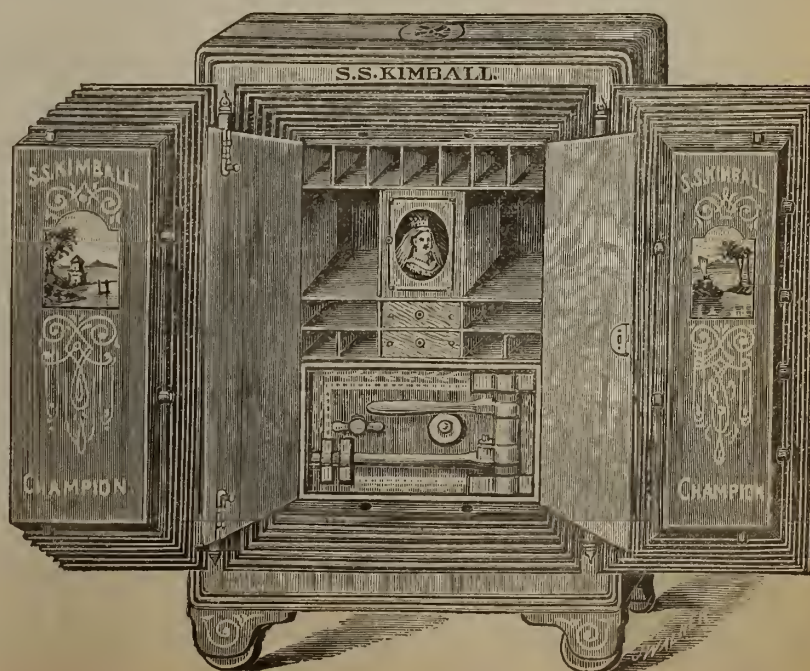
Readers of the REVIEW desiring extra copies of SCIENTIFIC AGRICULTURE should SEND IN THEIR ORDERS NOW. A few SPACES are still open and contracts may be made at reasonable rates. Address Manager, THE CANADIAN MINING REVIEW, OTTAWA.

Champion Fire and Burglarproof Safes.

These Safes have the best record of any in the Dominion. Price 30 per cent. cheaper than any other first-class Safe.

SEND FOR CATALOGUE AND PRICE-LIST.

S. S. KIMBALL,
577 Craig St., Montreal.





DEPARTMENT OF Inland Revenue.

AN ACT RESPECTING AGRICULTURAL FERTILIZERS.

The public is hereby notified that the provisions of the Act respecting AGRICULTURAL FERTILIZERS came into force on the 1st of January, 1886 and that all Fertilizers sold thereafter require to be sold subject to the conditions and restrictions therein contained—the main features of which are as follows:

The expression "fertilizer" means and includes all fertilizers which are sold at more than TEN DOLLARS per ton, and which contains ammonia, or its equivalent of nitrogen, or phosphoric acid.

Every manufacturer or importer of fertilizers for sale, shall, in the course of the month of January in each year, and before offering the same fertilizer for sale, transmit to the Minister of Inland Revenue, carriage paid, a sealed glass jar, containing at least two pounds of the fertilizer manufactured or imported by him, with the certificate of analysis of the same, together with an affidavit setting forth that each jar contains a fair average sample of the fertilizer manufactured or imported by him; and such sample shall be preserved by the

Minister of Inland Revenue for the purpose of comparison with any sample of fertilizer which is obtained in the course of the twelve months then next ensuing from such manufacturer or importer, or collected under the provisions of the Adulteration Act, or is transmitted to the chief analyst for analysis.

If the fertilizer is put up in packages, every such package intended for sale or distribution within Canada shall have the manufacturer's certificate of analysis placed upon or securely attached to each package by the manufacturer; if the fertilizer is in bags, it shall be distinctly stamped or printed upon each bag; if it is in barrels, it shall be either branded, stamped or printed upon the head of each barrel or distinctly printed upon good paper and securely pasted upon the head of each barrel, or upon a tag securely attached to the head of each barrel; if it is in bulk, the manufacturer's certificate shall be produced and a copy given to each purchaser.

No fertilizer shall be sold or offered or exposed for sale unless a certificate of analysis and sample of the same shall have been transmitted to the Minister of Inland Revenue and the provisions of the foregoing sub-section have been complied with.

Every person who sells or offers or exposes for sale any fertilizer, in respect of which the provisions of this Act have not been complied with—or who permits a certificate of analysis to be attached to any package, bag or barrel of such fertilizer, or to be produced to the inspectors to accompany the bill of inspection of such inspector, stating that the fertilizer contains a larger percentage of the constituents mentioned in sub-section No. 11 of the Act than is contained therein—or who sells, offers or exposes for sale any fertilizer purporting to have been inspected, and which does not contain the percentage of constituents mentioned in the next preceding section—or who sells or offers or exposes for sale any fertilizer which does not contain the per-

centage of constituents mentioned in the manufacturer's certificate accompanying the same, shall be liable in each case to a penalty not exceeding fifty dollars for the first offence, and for each subsequent offence to a penalty not exceeding one hundred dollars. Provided always that deficiency of one per centum of the ammonia, or its equivalent of nitrogen, or of the phosphoric acid, claimed to be contained, shall not be considered as evidence of fraudulent intent.

The Act passed in the forty-seventh year of Her Majesty's reign, chaptered thirty-seven and entitled, "*An Act to prevent fraud in the manufacture and sale of agricultural fertilizers*," is by this Act repealed, except in regard to any offence committed against it or any prosecution or other act commenced and not concluded or completed, and any payment of money due in respect of any provision thereof.

A copy of the Act may be obtained upon application to the Department of Inland Revenue, as well as a copy of a Bulletin which it is proposed to issue in April, 1888, concerning the fertilizers

E. MIALI,
Commissioner.

January, 1889.

PROPERTIES FOR SALE.

Parties having developed or undeveloped mineral lands for sale will find the REVIEW an admirable medium for bringing them before the notice of CAPITALISTS and INVESTORS in GREAT BRITAIN and the UNITED STATES.



Intercolonial Railway OF CANADA.

The direct route between the West and all points on the St. Lawrence and Baie des Chaleur, Province of Quebec; also for New Brunswick, Nova Scotia, Prince Edward, Cape Breton and the Magdalene Islands, Newfoundland and St. Pierre.

EXPRESS TRAINS leave Montreal and Halifax daily (Sunday excepted) and run through without change between these points in 30 hours.

The Through Express Train cars of the Intercolonial Railway are brilliantly lighted by electricity and heated by steam from the locomotive.

New and Elegant Buffet Sleeping and Day Cars are run on all through Express Trains.

The popular Summer Sea Bathing and Fishing Resorts of Canada are along the Intercolonial, or are reached by that route.

CANADIAN EUROPEAN MAIL AND PASSENGER ROUTE.

Passengers for Great Britain or the Continent by leaving Montreal on Thursday morning will join Outward Mail Steamer at Rimouski the same evening.

The attention of shippers is directed to the superior facilities offered by this route for the transport of flour and general merchandise intended for the Eastern Provinces and Newfoundland; also for shipments of grain and produce intended for the European market.

Tickets may be obtained and all information about the route, also Freight and Passenger rates, on application to

G. W. ROBINSON,
Eastern Freight and Passenger Agent,
137½ St. James St., MONTREAL.

E. KING,
27 Sparks Street,
OTTAWA.

D. POTTINGER,
Chief Superintendent.

Railway Offices, Moncton, N.B.
2nd July, 1889.

The Polson Iron Works Co'y TORONTO, ONT.

Manufacturers of the Celebrated "Brown Automatic Engine."

GENERAL DEALERS IN

MINING MACHINERY.

SPECIAL AGENTS FOR

Knowles' Steam Pumps,

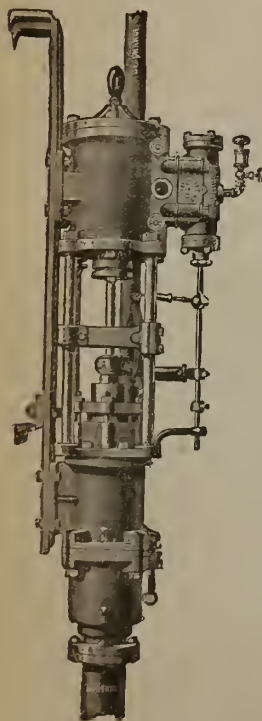
B. T. Sturtevant's Blowers and Fans,

Burleigh Rock Drills.

Hoisting Engines and Boilers, Quartz Mills, Diamond Prospecting Drills, Rock Breakers.

Office and Works, Esplanade E.; Warehouse, 38 Yonge St.,

TORONTO.





Mining Regulations

TO GOVERN THE DISPOSAL OF

Mineral Lands other than Coal Lands, 1886.

THESE REGULATIONS shall be applicable to all Dominion Lands containing gold, silver, cinnabar, lead, tin, copper, petroleum, iron or other mineral deposits of economic value, with the exception of coal.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein either by surface or subterranean prospecting for mineral deposits, with a view to obtaining under the Regulations a mining location for the same but no mining location or mining claim shall be granted until the discovery of the vein, lode or deposit of mineral or metal within the limits of the location or claim.

QUARTZ MINING

A location for mining, except for iron on veins, lodes or ledges of quartz or other rock in place shall not exceed forty acres in area. Its length shall not be more than three times its breadth and its surface boundary shall be four straight lines, the opposite sides of which shall be parallel, except where prior locations would prevent, in which case it may be of such a shape as may be approved of by the Superintendent of Mining.

Any person having discovered a mineral deposit may obtain a mining location therefor, in the manner set forth in the Regulations which provides for the character of the survey and the marks necessary to designate the location on the ground.

When the location has been marked conformably to the requirements of the Regulations, the claimant shall within sixty days thereafter, file with the local agent in the Dominion Land Office for the district in which the location is situated, a declaration or oath setting forth the circumstances of his discovery, and describing, as nearly as may be, the locality and dimensions of the claim marked out by him as aforesaid; and shall, along with such declaration, pay to the said agent an entry fee of FIVE DOLLARS. The agent's receipt for such fee will be the claimant's authority to enter into possession of the location applied for.

At any time before the expiration of FIVE years from the date of his obtaining the agent's receipt it shall be open to the claimant to purchase the location on filing with the local agent proof that he has expended not less than FIVE HUNDRED DOLLARS in actual mining operations on the same; but the claimant is required, before the expiration of each of the five years, to prove that he has performed not less than ONE HUNDRED DOLLARS' worth of labor during the year in the actual development of his claim, and at the same time obtain a renewal of his location receipt, for which he is required to pay a fee of FIVE DOLLARS.

The price to be paid for a mining location shall be at the rate of FIVE DOLLARS PER ACRE, cash, and the sum of FIFTY DOLLARS extra for the survey of the same.

No more than one mining location shall be granted to any individual claimant upon the same lode or vein.

IRON.

The Minister of the Interior may grant a location for the mining of iron, not exceeding 160 acres in area which shall be bounded by north and south and east and west lines astronomically, and its breadth shall equal its length. Provided that should any person making an application purporting to be for the purpose of

mining iron thus obtain, whether in good faith or fraudulently, possession of a valuable mineral deposit other than iron his right in such deposit shall be restricted to the area prescribed by the Regulations for other minerals, and the rest of the location shall revert to the Crown for such disposition as the Minister may direct.

The Regulations also provide for the manner in which land may be acquired for milling purposes reduction works or other works incidental to mining operations.

Locations taken up prior to this date may, until the 1st of August, 1886, be re-marked and re-entered in conformity with the Regulations without payment of new fees in cases where no existing interests would thereby be prejudicially affected.

PLACER MINING.

The Regulations laid down in respect to quartz mining shall be applicable to placer mining as far as they relate to entries, entry fees, assignments, marking of localities, agents' receipts, and generally where they can be applied.

The nature and size of placer mining claims are provided for in the Regulations, including bar, dry, bench creek or hill diggings, and the RIGHTS AND DUTIES OF MINERS are fully set forth.

The Regulations apply also to

BED-ROCK FLUMES, DRAINAGE OF MINES AND DITCHES.

The GENERAL PROVISIONS of the Regulations include the interpretation of expressions used therein; how disputes shall be heard and adjudicated upon; under what circumstances miners shall be entitled to absent themselves from their locations or diggings, etc., etc.

THE SCHEDULE OF MINING REGULATIONS

Contains the forms to be observed in the drawing up of all documents such as:—"Application and affidavit of discoverer of quartz mine." "Receipt for fee paid by applicant for mining location." "Receipt for fee on extension of time for purchase of a mining location." "Patent of a mining location." "Certificate of the assignment of a mining location." "Application for grant for placer mining and affidavit of applicant." "Grant for placer mining." "Certificate of the assignment of a placer mining claim." "Grant to a bed rock flume company." "Grant for drainage." "Grant of right to divert water and construct ditches."

Since the publication, in 1884, of the Mining Regulations to govern the disposal of Dominion Mineral Lands the same have been carefully and thoroughly revised with a view to ensure ample protection to the public interests, and at the same time to encourage the prospector and miner in order that the mineral resources may be made valuable by development.

COPIES OF THE REGULATIONS MAY BE OBTAINED UPON APPLICATION TO THE DEPARTMENT OF THE INTERIOR

A. M. BURGESS,

Deputy Minister of the Interior.

SEND FOR SAMPLES AND PRICES FOR

Asbestos Bags, Phosphate Bags, Ore Bags, &c.,

SPECIAL SIZES MADE TO ORDER.

DOUBLE SEWN.

DICK, RIDOUT & CO.,

PROPRIETORS TORONTO BAG WORKS,

Office and Warehouse: 11-13 Front St. East. Factory: 14, 16, 18, 20, 22 Bay St.

ESTABLISHED 1887.

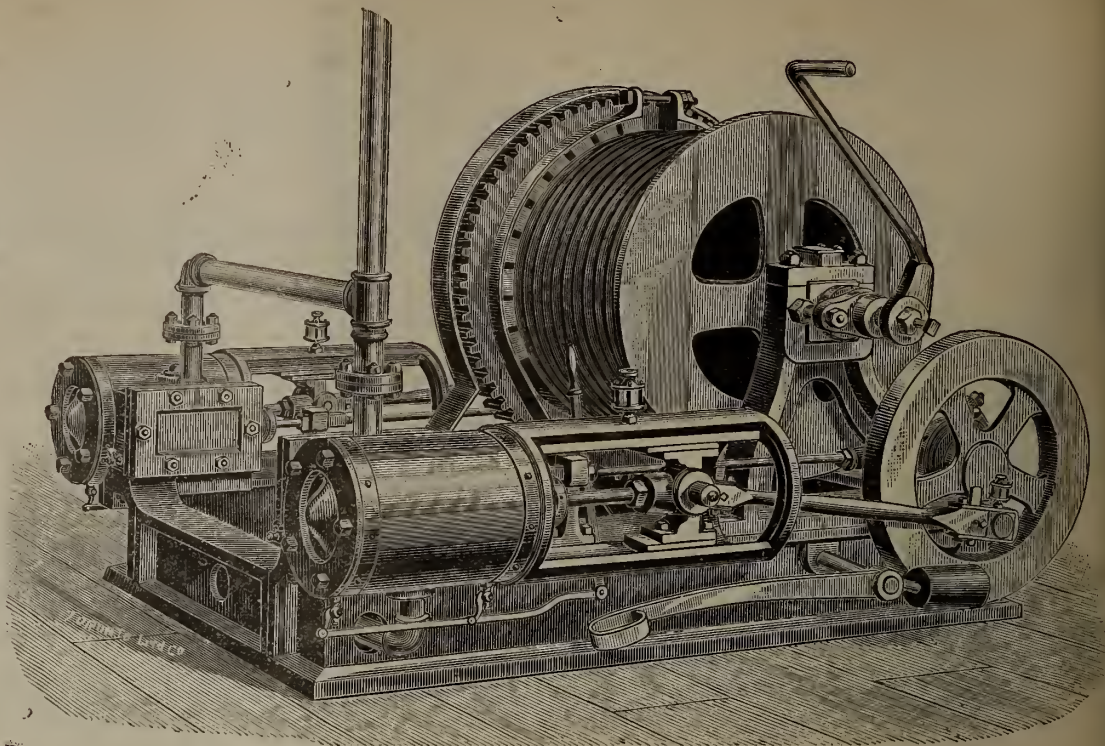
TORONTO.

JOHN DOTY ENGINE CO.

Toronto, Ont.

MANUFACTURERS OF

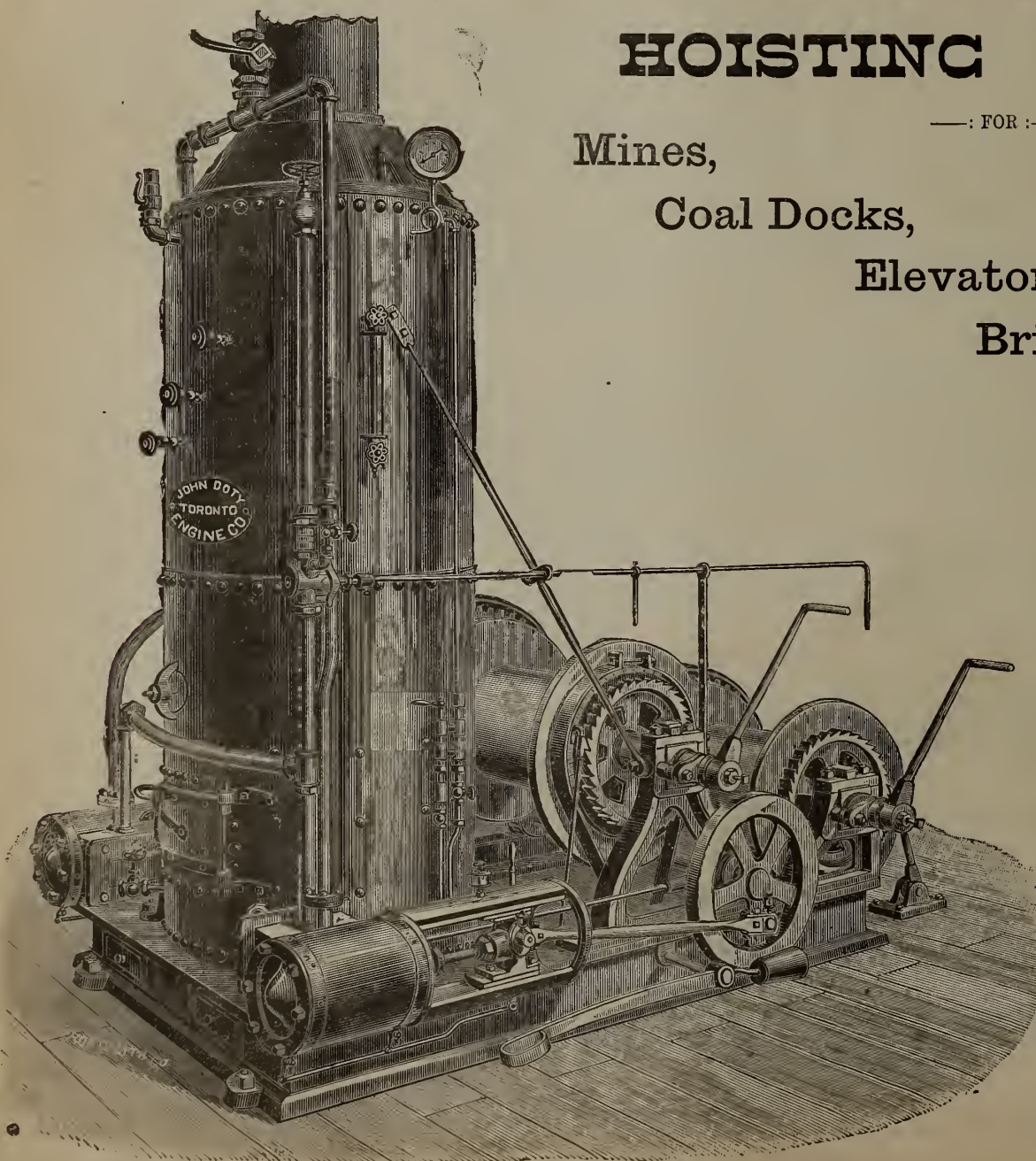
Mining & General
Machinery.



HOISTING ENGINES

—: FOR :—

Mines,
Coal Docks,
Elevators,
Bridge Builders,
Contractors, &c.



CORLISS ENGINES

Tug & Steam Yacht Engines,
Mill Engines.

Shafting & Mill
Gearing.

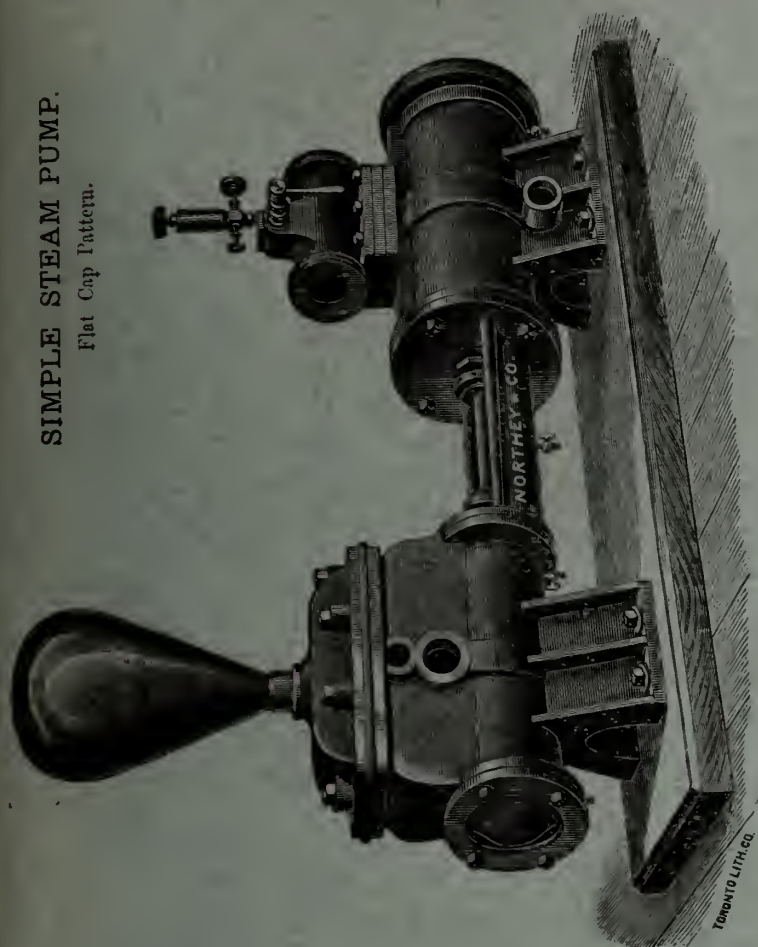
All Descriptions of Boiler
and Tank Work.

Send for Estimates and
Catalogues.

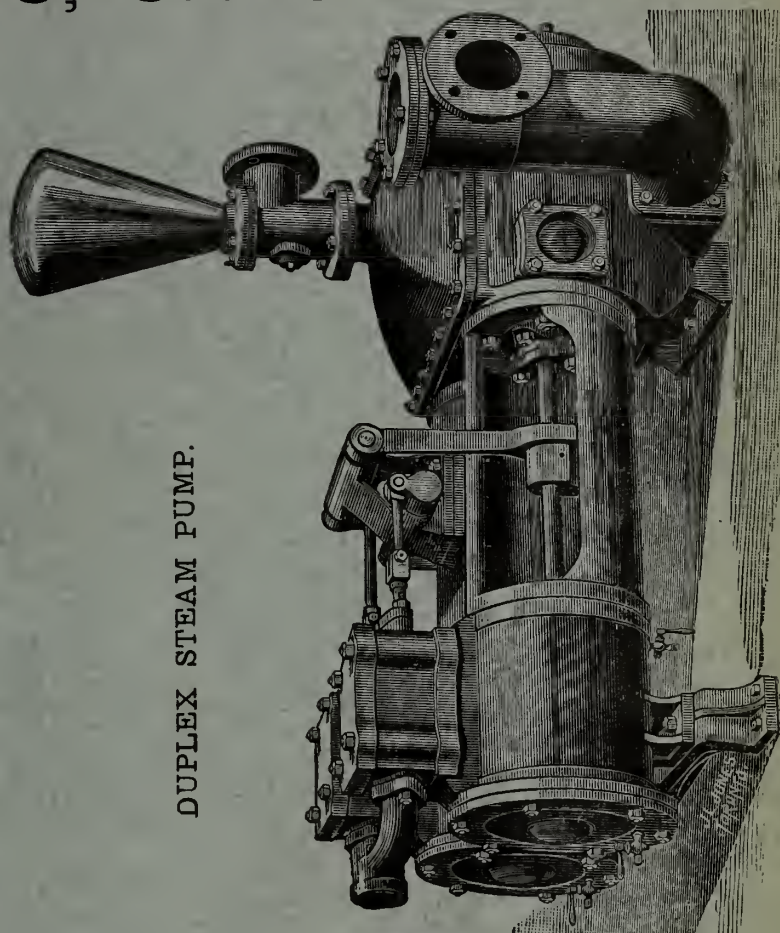
Northey & Co's Steam Pump Works, TORONTO, ONT.

SIMPLE STEAM PUMP.

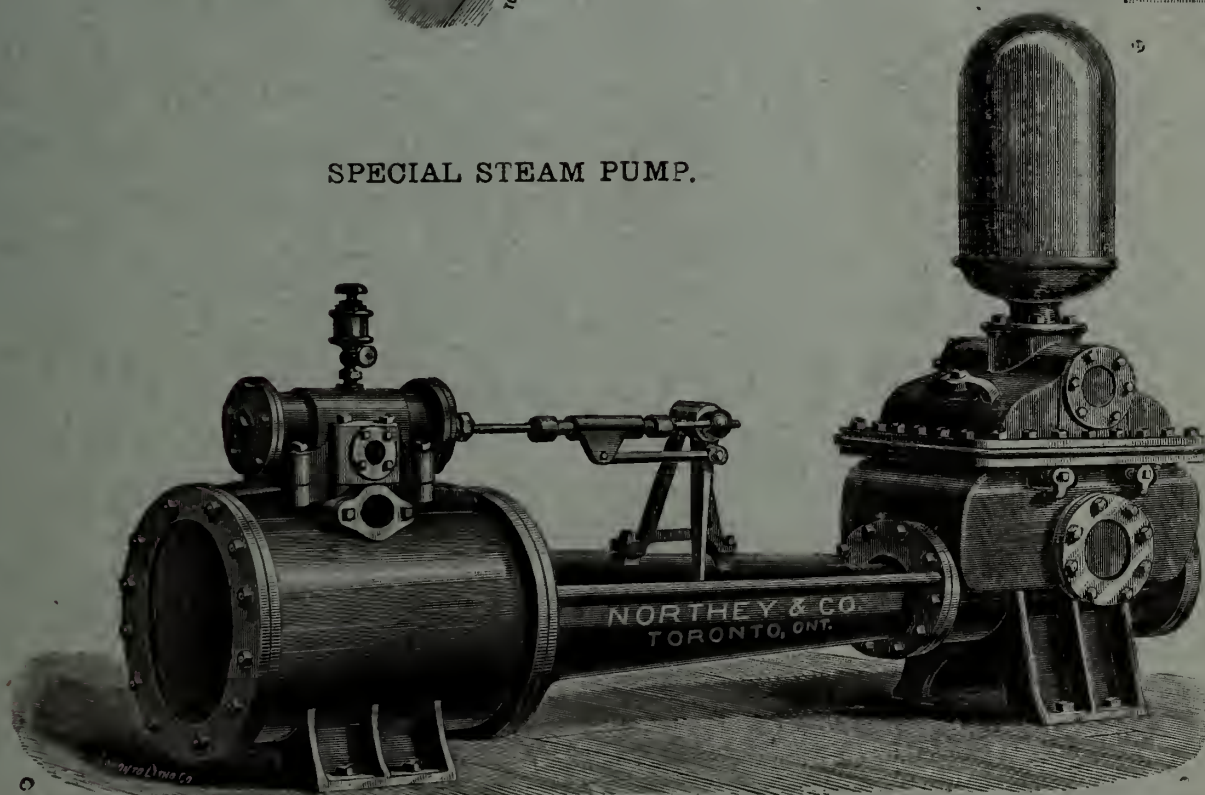
Flat Cap Pattern.



DUPLEX STEAM PUMP.



SPECIAL STEAM PUMP.



Steam Pumps of the best and latest designs for mining purposes, Boiler Feeding, Fire Protection, and General Water Supply, etc.

NORTHEY & CO.,
Mechanical  Hydraulic Engineers,    Toronto, Ont.
WORKS—COR. FRONT AND PARLIAMENT STS.

A. R. WILLIAMS,

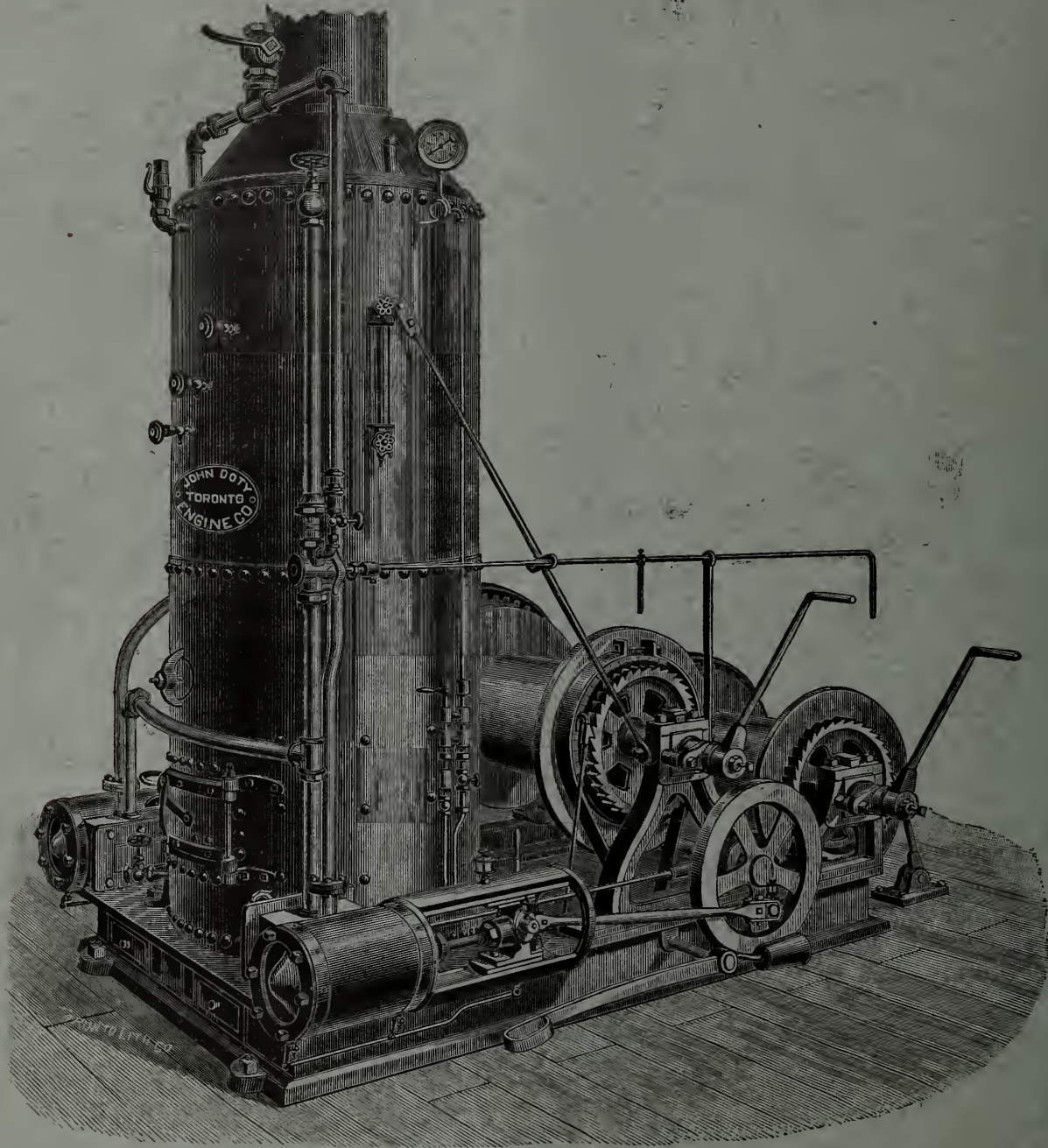
SOHO MACHINE WORKS,

TORONTO,

ONTARIO.

MANUFACTURER AND DEALER IN

MACHINERY AND SUPPLIES.



Duplex Steam Pumps, all sizes. Every Pump Guaranteed.

VERY LOW PRICES.

Portable Engines, Hoisting Engines, Stationary Engines, Iron and Wood Working Machinery, Ventilating Fans, Saw Mill and Shingle Mill Machinery. Full lines of Machinery and Supplies. Send for Catalogue.

MINING REVIEW

Canadian

Established 1882

Vol. VIII.—No. 8.

1889.—OTTAWA, AUGUST—1889.

Vol. VIII.—No. 8.

1889 CATALOGUE OF 200 PAGES, 1889. ROCK DRILLING AND AIR COMPRESSING.

This Catalogue is one of unusual interest and value.—*R.R. Gazette*.
Should be in the hands of every engineer and Contractor.—*Eng. and Min. Journal*.
Satisfies a long felt want.—*Manufacturers Record*.
This is a thoroughly good publication.—*Engineering News*.
A valuable addition to the literature on the subject.—*Eng and B'g Record*.
The matter is readily available.—*Tradesman*.
A complete work.—*Colliery Engineer*.
Highly for reference.—*Min. and Sc. Press*.
The United Information will be specially valuable.—*Eng. and B'g Record*.
It really a hand book.—*Am. Manufacturer*.

RAND DRILL CO., 23 PARK PLACE, NEW YORK.

Hamilton Powder COMPANY,

Manufacture Mining, Blasting, Military
and Sporting

Gunpowder,

DYNAMITE, DAULIN, and the new
ECLIPSE MINING POWDER

DOMINION AGENTS FOR

Safety Fuse. Electric Blasting
Apparatus, &c.

OFFICE

103 St. FRANCOIS XAVIER STREET.
MONTREAL.

BRANCH OFFICES & MAGAZINES
at all chief distributing points
in Canada.

CANADA ATLANTIC RAILWAY.

THE SHORTEST PASSENGER ROUTE
BETWEEN

Ottawa and Montreal,
AND ALL POINTS EAST & SOUTH.

The only road in Canada running trains lighted
with electricity and heated by steam from the
engine. Luxurious Buffet Pullman Palace Cars
on all trains between Ottawa and Montreal. Only
line running through Sleeping Cars between

Ottawa, Boston and New York

And all New England and New York points.

Baggage checked to all points and passed by Customs in transit.

During season of navigation close connections
are made with Richelieu and Ontario Navigation
Company's Steamers at Coteau Landing, shooting
the St. Lawrence Rapids.

For Tickets, Time Tables and information apply
to nearest agent, or to

S. EBBS, City Passenger Agent,
24 Sparks St., OTTAWA.

GEO. H. PHILLIPS, Gen. Agent,
VALLEYFIELD.

A. E. CAIRNS, General Agent,
136 St. James St., MONTREAL.

Or at 260 Washington St., Boston, and
317 Broadway, New York.

PERCY R. TODD,
General Passenger Agent.

E. J. CHAMBERLAN,
General Manager,
General Offices, Ottawa.

THE CANADIAN RUBBER CO. OF MONTREAL.

A. ALLAN, Pres.

J. O. GRAVEL, Secy.-Treas.

F. SCHOLES, M'g. Dir.

Manufacturers of

SUPERIOR QUALITY
RUBBER GOODS.

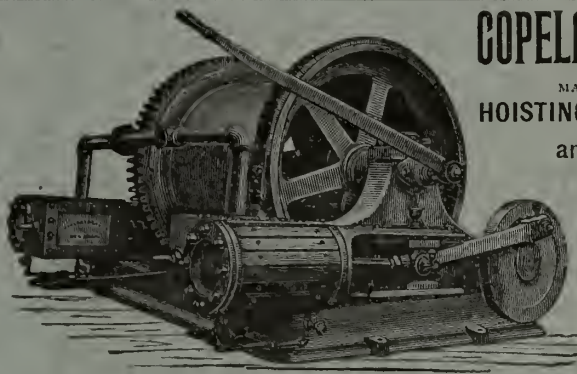
Our Rubber Belting is Un-
equalled in America.

Rubber Packings of all kinds.
Rubber Engine, Hydrant, Suction,
Steam, Brewers' and Fire Hose.
Moulded Goods of every description.

J. H. WALKER, Manager.



Western Branch cor. Front and Yonge Sts.,
TORONTO.



COPELAND & BACON

MANUFACTURERS OF
HOISTING ENGINES,
and MINING PLANTS.

85 Liberty St.
NEW YORK.

Send for Catalogue.

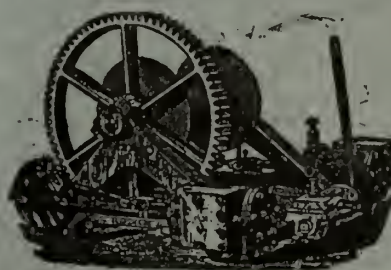
MILLER BROS. & MITCHELL

MANUFACTURERS OF
Steam Rock Drills

AND

HOISTING ENGINES,
Mining & Contractors' Plant
&c., &c.

110 TO 120 KING STREET, MONTREAL, QUE.



THE

BELL TELEPHONE CO. OF CANADA.

ANDREW ROBERTSON, . . . PRESIDENT
C. F. SISE, . . . VICE-PRESIDENT
C. P. SCLATER, . . . SECRETARY-TREASURER

HEAD OFFICE, . MONTREAL.

H. C. BAKER, Manager Ontario Department,
HAMILTON.

This Company will sell its instruments at prices
ranging from \$10 to \$25 per set. These instru-
ments are under the protection of the Company's
patents, and purchasers are therefore entirely free
from risk of litigation.

This Company will arrange to connect places
not having telegraphic facilities with the nearest
telegraph office, or it will build private lines for
firms or individuals, connecting their places of
business or residences. It is also prepared to
manufacture all kinds of electrical apparatus.

Full particulars can be obtained at the Com-
pany's offices as above, or at St. John, N.B., Hal-
ifax, N.S., Winnipeg, Man., Victoria, B.C.



MISS M. E. ORR.

REMINGTON STANDARD TYPEWRITER

Miss Orr, Championess
of the world and Gold Medal
at Toronto, 13th August,
1888.

GEORGE BENGOUGH,
GENERAL AGENT,
36 King Street, TORONTO.

ALEX. FLECK JUN.,

Manufacturer of every Description of

Mill Machinery

Water Wheels, Steam Engines,
Boilers, Derricks, Steam
Pumps and Mining
Machinery.

Brass and Iron Casting of every
Description.

VULCAN IRON WORKS, WELLINGTON ST
OTTAWA.

DYNAMO ELECTRIC MACHINES and LAMPS



ARC and INCANDESCENT

FOR MINING PURPOSES

New York Belting & Packing Co.

15 PARK ROW, NEW YORK

JOHN H. CHEEVER, Treasurer.

J. D. CHEEVER, Dep'ty Treasurer.

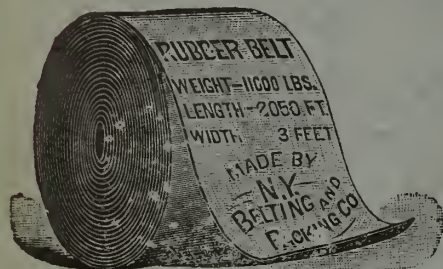
Oldest and largest Manufacturers in the United States of

VULCANIZED RUBBER FABRICS

FOR MECHANICAL PURPOSES.

EXTRA RUBBER BELTING AND HOSE

FOR MINING PURPOSES.



RUBBER BELTING.

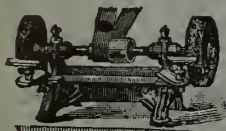
CIRCULAR WOVEN SEAMLESS, ANTI-SEPTIC RUBBER LINED

"CABLE" HOSE and TEST HOSE

For the use of Steam Engines, Force Pumps, Rolling Mills, Iron Works, Factories, etc. Woven in a superior manner to insure wear, compactness and durability.



"TEST HOSE."



SOLID VULCANITE EMERY WHEELS

(Large Wheels made on iron centers)

Cuts Cooler and Freer than any other wheel in the market.

Emery Vulcanite Wheel.

SALESROOMS:—Chicago, 151 Lake St.; Detroit, 16-24 Woodward Ave.;

Boston, 52 Summer St.; Cleveland, 176 Superior St.

European Branch: Pickhuben, 5, Hamburg (Freihafengebeit), Germany.

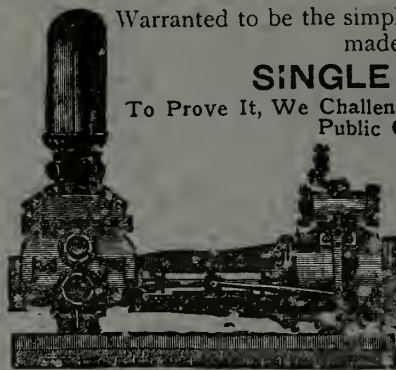
The M. T. DAVIDSON

IMPROVED MINING PUMP.

Warranted to be the simplest and most efficient Steam Pump made, whether it be

SINGLE OR DUPLEX.

To Prove It, We Challenge All Makers of Steam Pumps to a Public Competitive Test.



COMPOUND PUMPING ENGINES,

Obtaining a higher duty than any direct-acting pump made.

MANUFACTURED BY THE

Davidson Steam Pump
COMPANY.

New York Office, - - - 77 Liberty Street.

ROOT'S

SPIRAL RIVETED PIPE

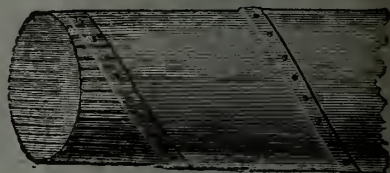
FOR

Hydraulic Mining,

Water Works

Ranch and Railroad

Water Supplies.



From 2 to 24 inches in diameter and 1 to 25 in length. Manufactured with fittings to suit, capable of withstanding any desired pressure.

ABENDROTH & ROOT MFG. CO.

28 Cliff Street, New York.

Chicago Branch, - - SMITH & KNAPP, 62 South Canal Street

LIDGERWOOD MANUF'G CO.

96 LIBERTY ST, NEW YORK,

34 & 36 WEST MONROE ST. CHICAGO, 197 TO 203 CONGRESS ST. BOSTON,

Largest Manufacturers in the United States of Hoisting Machinery of Every Description for Mines, Tunnel Work, Contractors, and General Hoisting Purposes.

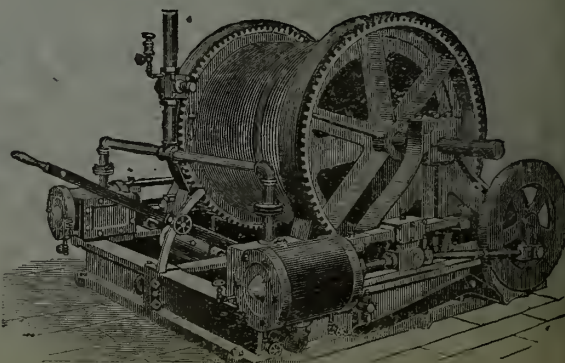
IMPROVED HOISTING ENGINES

FOR MINING PURPOSES A SPECIALTY.

Over 5,000 Engines in Use!

300 Styles
and Sizes.

Send for
CATALOGUE.



1000 : Cylinder Reversible Mine Engine.



FRICTION DRUM PORTABLE HOISTING ENGINE.

F. G. BECKETT ENGINE CO.

HAMILTON, ONT.



Having had many years practical experience in the manufacture of

MINING MACHINERY

IS NOW PREPARED TO CONTRACT FOR

Stamp Mill Machinery,
Concentration Mills,
Revolving, Roasting and
Drying Furnaces.
Rock Breakers,
Cornish Rolls for crushing,
Amalgamating Pans and Settlers,
Concentrators and
Revolving Screens,
Smelting Furnaces, Retorts,

HOISTING ENGINES,

EITHER GEARED OR DIRECT ACTION.

Cornish Pumping Machinery,
Iron Ore Cars, Safety Cages, &c.,
Rock Drills and Air Compressors.

STEAM ENGINES AND BOILERS.

Marine Engines and Steam Yachts.

Francis D. Taylor
MINING ENGINEER,
BROCKVILLE, - ONTARIO

SPECIALTY. — The Mining of Iron Ores,
Coals, and the Manufacture of Iron and Steel.

Mr. T. has had for many years the manage-
ment of large mining enterprises in England
and the U. S. A.

CAMERON STEAM PUMP
SIMPLE, RELIABLE, COMPACT, DURABLE.
NO OUTSIDE VALVE GEAR.
THE A.S. CAMERON STEAM PUMP WORKS.
ADAPTED FOR ALL PURPOSES.
FOOT OF EAST 23rd STREET, NEW YORK.



DOMINION ASSAY OFFICE AND MINING BUREAU.

Prospecting, Surveying and Examinations by Experts.
Mining properties purchased or floated on the European
markets; Capital found for developing same. Interest
in good mining property secured.

London Office: 21 Richmond St. E. } TORONTO
33 King St., Cheapside. 44 Victoria St.

**TAYLOR McVEITY,
Barrister, Solicitor, &c.,**

Supreme Court and Departmental Agent,
SCOTTISH ONTARIO CHAMBERS, OTTAWA.

WM. HAMILTON MERRITT, F.G.S.

Associate Royal School of Mines, &c.,
Mining Engineer and Metallurgist,
Will report on Mines and Mineral Properties.

ADDRESS:
15 TORONTO ST., TORONTO, ONT.

J. T. DONALD, M. C. E.,

Analytical Chemist and Assayer,
124 St. JAMES St. - MONTREAL.
Analyses and Assays of every description. Manufactur-
ing processes practically tested. Laboratory instruction
in Chemistry, Assaying and Mineralogy. Terms on
application.

**THE DOMINION
Leather Board Co.**
MONTREAL,
— MANUFACTURERS OF —

Leather Board & Stiffeners

ALSO OF
**ASBESTOS MILL BOARD,
STEAM PACKING, and
FRICTION PULLEY BOARD.**

Samples and prices furnished upon ap-
plication.
Please mention this paper.



**ONTARIO
Mining Regulations.**

The following summary of the principal
provisions of the General Mining Act of
the Province of Ontario is published for
the information of those interested in
mining matters in the Algoma District,
and that part of the Nipissing District
north of the Mattawan River, Lake Nipis-
sing and French River.

Any person or persons may explore for
mines or minerals on any Crown Lands
surveyed or unsurveyed, not marked or
staked out or occupied.

The price of all lands sold as mining
locations or as lots in surveyed townships
is two dollars per acre cash, the pine timber
being reserved to the Crown. Patentees
or those claiming under them may cut and
use such trees as may be necessary for
building, fencing or fuel, or for any other
purpose essential to the working of mines.

Mining locations in unsurveyed territory
shall be rectangular in shape, and the
bearings of the outlines thereof shall be due
north and south, and due east and west
astronomically, and such locations shall be
one of the following dimensions, viz: eighty
chains in length by forty chains in width,
containing 320 acres, or forty chains square,
containing 160 acres, or twenty chains in
length by twenty chains in width, con-
taining 80 acres.

All such locations must be surveyed by
a Provincial Land Surveyor, and be con-
nected with some known point or boundary
at the cost of the applicant, who must file
with application surveyor's plan, field notes
and description of location applied for.

In all patents for mining locations a
reservation of five per cent. of the acreage
is made for roads.

Lands patented under the Mining Act
are free from all royalties or duties in re-
spect to any ores or minerals thereon, and
no reservation or exception of any mineral
is made in the patents.

Lands situated south of the Mattawan
River, Lake Nipissing and French River
are sold under the Mining Act at one
dollar per acre cash.

Affidavits showing no adverse occupa-
tion, improvement or claim should ac-
company applications to purchase.

A. S. HARDY,
Commissioner,
Department of Crown Lands, Toronto.

The Canada Co.

Will issue Licences to Prospect or
to work Minerals on any of
their Mining Lands and
Mineral Reservations,
Covering nearly a

Quarter of a Million Acres

In Eastern Ontario, and principally
within the belts containing

Iron, Phosphate, Gold, Galena
Plumbago, Mica, Marbles,
Building Stone,
and other valuable Minerals.

For list of lands and terms apply to the
Company's Mining Inspectors,

H. T. STRICKLAND,
Peterborough, Ont.,

For lands in the County of Hastings and
westward, and to

ANDREW BELL, P.L.S.,
Almonte, Ont.,

For lands East of the County of Hastings

TO MINERS AND OTHERS.

Bannerman & Powers,

VULCAN BOILER WORKS.

428 and 340 Wellington St., Ottawa.

MANUFACTURERS OF

IRON AND STEEL BOILERS

OF EVERY DESCRIPTION.

Tanks, Girders, Iron Roof-
ing, Bank Vaults, Smoke
Stacks

—AND ALL KINDS OF—

SHEET IRON WORK.

Repairs Neatly and Promptly Executed

FENWICK & SCLATER,

Manufacturers of Asbestos, Fire Hose, Files and Cotton
Waste, Miners of Asbestos and Soapstone,

ASBESTOS

Cotton, Leather and Rubber Belting,

42, 44 & 46 Foundling Street, Montreal.

H. R. IVES & CO.,

Hardware Manufacturers and Founders,
QUEEN ST., MONTREAL.

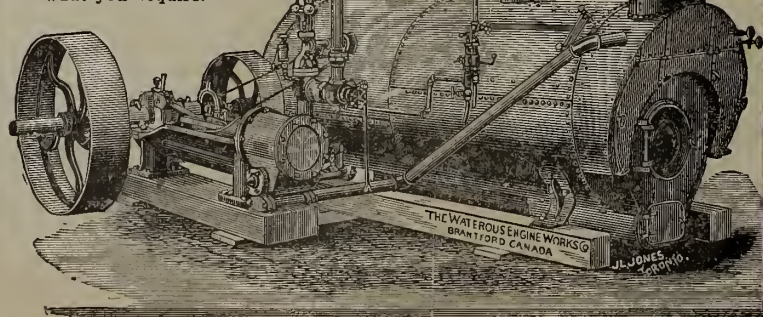
STOVES.	PORTABLE	MONTREAL	CASTINGS
TRADE MARK "Buffalo"	FORGES.	SMELTING CO'S	Of every description
IRON	—	BABBIT	to order.
BEDSTEADS	BLACKSMITH'S	METAL.	SOIL PIPE.
FOR MINERS' USE.	DRILLS.		

PORTABLE ENGINES AND SAW-MILLS

Of all capacities—from 3000 feet of lumber and up per day.

Saw-Mills. Shingle-Mills. Lath-Mills. Chopping-Mills.
OF ALL SIZES.
BOILERS of all capacities, IRON OR STEEL, ALL STYLES.

Send for Circulars, stating
what you require.



Waterous Engine Works Co. Brantford, Canada.
St. Paul, Minn., U.S.A.

JOHN E. HARDMAN, S.B.
MINING ENGINEER,
OLDHAM, NOVA SCOTIA.

Can be consulted on all matters pertaining to the profession.
 The development and management of Gold Properties a specialty.

WILSON & GREEN,
Commission Merchants,
PHOSPHATE SHIPPERS.
AGENTS HIGH ROCK MINE.
 30 St. François Xavier St., - MONTREAL.

EDMUND SPARGO,
 Consulting and Mining Engineer, 3 Cable Street,
 Liverpool.
 Owners of or Investors in Metalliferous Mines, Slate, Granite,
 and other Stone Quarries, Brick, Terra Cotta, Fire and other Clays
 and Mineral Estates in general, requiring reliable and sound ad-
 vice either in the Purchase or Disposal thereof, should consult E.S.,
 who has executed important professional Commissions in Germany,
 Austria, Hungary, France, Belgium, Spain, Portugal, Sweden,
 Norway, and in the various Mining Districts throughout Great
 Britain and Ireland. Telegraphic Address: "Spargo," Liverpool.
 Bankers, National Provincial Bank of England, Liverpool.

THOMAS HEYS,
 Analytical and Consulting Chemist and Assayer.
 References are kindly permitted by the following:
 Messrs. Golderham & Worts, Toronto, Limited; Messrs. P. R.
 Lamb & Co.; John Livingston, Esq., Dominion Bolt Co.
 Assay and Analytical Laboratory
 16 King St. West opposite the Rossin House, } **TORONTO.**

J. LAINSON WILLS,
F. C. S., ETC.
 Late Manager Canadian Phosphate Co. (Lim.),
 Reports upon Mines and Mining properties.
 Advice given on Chemical and Metallurgical processes.
SPECIALTIES: PHOSPHATE AND GOLD.
 TELEGRAPHIC OR POSTAL ADDRESS:
WILLS, BUCKINGHAM, P.Q.

Irwin, Hopper & Co.
MINERS AND SHIPPERS OF
MINERALS,
 30 St. François Xavier Street,
MONTREAL, CAN.
 Asbestos, crude and manufactured. Phosphate, Mica,
 Plumbago, Soapstone, &c.

JOHN D. FROSSARD, B.S., M.E.
MINING ENGINEER & GEOLOGIST,
 30 St. François Xavier St., - - Montreal.
 Specialty—Phosphate Lands. &c.

JAMES HOPE & CO.,
BOOKSELLERS,
Stationers, Bookbinders and Printers,
OTTAWA.

SPEIGHT & VanNOSTRAND,
Dominion and Provincial Land Surveyors,
Draughtsmen, Valuators, &c.
OFFICE: ROOM "J," FIRST FLOOR, TORONTO ARCADE,
YONGE ST., TORONTO.
 Surveys, Plans, Descriptions of Properties, etc., promptly executed.
 Timber Limits and Mining Claims Located.

MILLAR & CO.
General Merchants & Shipping Agents
 ATLANTIC CHAMBERS,
 209 COMMISSIONER ST., - MONTREAL
 Cable address, "Hoyer, Montreal." P.O. Box 1095.
 AGENT FOR The Canadian Phosphate Co., Ltd., of London, Eng.,
 The Montreal Union Abattoir Co., of Montreal, Can.
 English Correspondents Messrs. Couper, Millar & Co., Lon-
 don, England.



For Mining Hoisting Derricks, etc.



Strong Wire Cloth and Screens
 For Mining, etc., manufactured by
B. Greening & Co.
 HAMILTON, ONT.

NATIONAL COLONIZATION
Lottery!
 UNDER THE PATRONAGE OF
THE REV. FATHER LABELLE.

*Established in 1884 under the Act of Quebec, 31 Vict.,
 Chap. 36, for the benefit of the Diocesan Societies
 of Colonization of the Province of Quebec.*

CLASS D.
 DRAWINGS ON THIRD WEDNESDAY IN EVERY
 MONTH AT 2 P.M.

Prizes value \$50,000
 Capital Prize: 1 Real Estate worth \$5,000.

LIST OF PRIZES.		
1 Real Estate worth	\$5,000	\$5,000
1 Real Estate worth	2,000	2,000
1 Real Estate worth	1,000	1,000
4 Real Estates	500	2,000
10 Real Estates	300	3,000
30 Furniture Sets	200	6,000
60 Furniture Sets	100	6,000
200 Gold Watches	50	10,000
1000 Silver Watches	10	10,000
1000 Toilet Sets	5	5,000

2307 Prizes worth \$50,000
Tickets, \$1.00!

Offers are made to all winners to pay their prizes cash,
 less a commission of 10 p. c. Winners' names not pub-
 lished unless specially authorized.
 S. E. LEFEBVRE, Secretary
 Office: 19 St. James St., Montreal, Can.

W. Blakemore, F.G.S., M.E.,
 Member of I. & S.I. | A. Montgomery Evans, M.E.
 of Canada & U.S.

BLAKEMORE & EVANS,
MINING & CIVIL ENGINEERS
 Exchange Buildings, Cardiff, S.W.

LONDON OFFICE:
 Robert H. Jones, 82 Queen St., Cheapside, London, E.C.

Reports, Estimates, and Valuations made on Iron and Steel Works
 Blast Furnaces, and all classes of Mining Properties.
CANADIAN BUSINESS PROMPTLY ATTENDED TO.

To Prevent Boiler Explosions
 And other accidents to steam boilers, and to secure
 economy in working, insure with

THE BOILER INSPECTION
AND INSURANCE COMPANY OF CANADA.

Sir Alex. Campbell, K.C.M.G., | John L. Blaikie, Esq.
 President. Vice-Pres.

HEAD OFFICE: - - - - - **TORONTO**
 G. C. ROBB, Chief Engineer.
 A. FRASER, Sec'y-Treas.

ORFORD COPPER CO.,
COPPER SMELTERS.

Works at Constable's Hook, N.J., opposite new Brigh-
 ton, Staten Island. Copper Ore, Mattes, or Bullion
 purchased. Advances made on consignments for re-
 fining and sale. Specialty made of Silver-Bearing
 Ores and Mattes.

SELL
INGOT AND CAKE COPPER.
President, ROBERT M. THOMPSON,
Treasurer, G. A. LAND.
Office, 37 to 39 Wall Street, New York.

Robin & Sadler,
MANUFACTURERS OF
LEATHER BELTING.

TRY OUR
Waterproof Belting,
 Just the thing for Mining Machinery.

MONTREAL, **TORONTO,**
 2518, 2520, 2522 Notre Dame St. 129 Bay Street.

Diamonds, Jewelry, Watches & Silverware
AT ROSENTHAL'S
Goldsmith's Hall, 87 Sparks St.
OTTAWA.

T. D. LEDYARD,
DEALER IN MINERAL LANDS
 4 ONTARIO CHAMBERS, TORONTO.

Will buy undeveloped iron ore and other mineral properties.
 WANTED. — Deposits of Magnetic Iron Ore, Red Hematite,
 Brown Hematite, Galena, Iron and Copper Pyrites, Mica, Soap-
 stone, Marble, Gypsum, Baryta. Samples can be sent by Sample
 Post for 1 cent for 4 oz. or up to 24 oz. in weight.
 Information regarding mines cheerfully given. Corresponden-
 solicited. Crown Land business attended to.

JAMES S. NOAD, MINING AGENT

AND PROMOTER OF AND DEALER IN

Mines and Mining Properties,
MONTREAL, CANADA.

MINES AND MINING PROPERTIES.

The undersigned, representing a London Syndicate, is prepared to negotiate for desirable Mines and Mining Properties, for the purpose of forming them into Joint Stock Companies, or providing cash capital for their proper development.

Address or call on

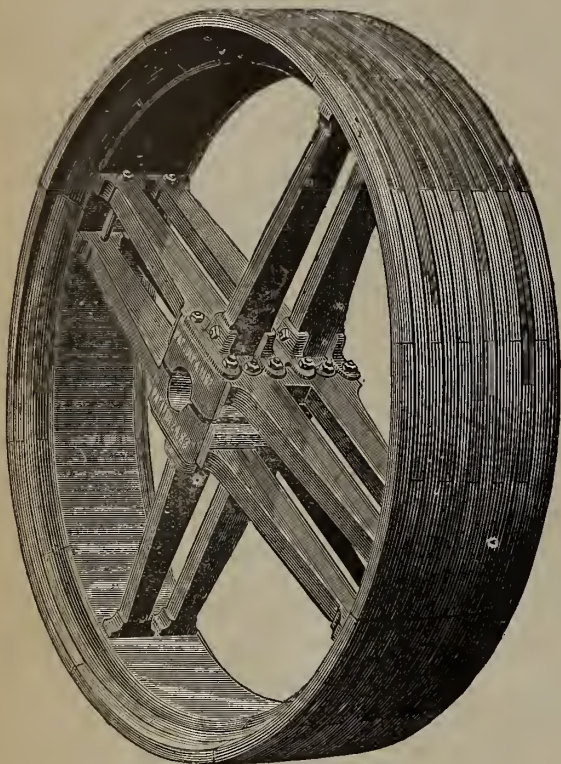
JAMES S. NOAD,

Montreal.

JAMES S. NOAD, MINING AGENT

AND PROMOTER OF AND DEALER IN

Mines and Mining Properties,
MONTREAL, CANADA.



DODGE PATENT

Wood Separable Split Pulleys

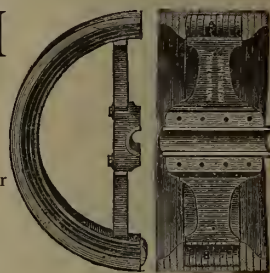
Best Belt Surface, Lightest, Strongest, Best Balanced and Most Convenient Pulley in the World.

WITH OUR PATENT BUSHING SYSTEM

In Comparing Prices of Pulleys please note carefully the following:

1. Our list is lower than most others.
2. Every Pulley is a Split Pulley.
3. Every Pulley is guaranteed to transmit from 25 to 60 per cent. more power than an iron one with same tension of belt.
4. Our Pulleys are 70 per cent. lighter than iron pulleys.
5. The fastening does not mar the shaft.
6. They are perfect in Balance.
7. They can be used on many different sizes of shafting.
8. They are the most thoroughly made wooden pulleys in the world.
9. And the handsomest pulley on the shaft.
10. No chances to take. Every pulley as represented or no sale.

Order a Sample Pulley, after which you will have no other.



EVERY PULLEY IS A SPLIT PULLEY
Made in any size from 9 inches to 16 ft. diameter
with original bores of 3 and 3 1/2 inches,
bushings to be used for intermediate sizes;
larger ones bored to order.

WE ALSO MANUFACTURE
WOODEN GROOVED PULLEYS FOR THE TRANSMISSION OF POWER
BY MANILLA ROPE,

Under the Dodge Patent System from 5 to 500 h. p. State power to be transmitted, speed of shafts, relative position of shafts, distance between shafts, and we can furnish a clear estimate.

EVERY PULLEY WILL FIT.

22 or more sizes of Shafting.
200 of our Pulleys and an assortment of bushings represent as many as 4,000 iron pulleys, a great advantage to dealers carrying stock.

Apply for particulars to THE DODGE WOOD SPLIT PULLEY CO., TORONTO.



USE GURNEY'S IMPROVED CELEBRATED Hot Water Heaters!

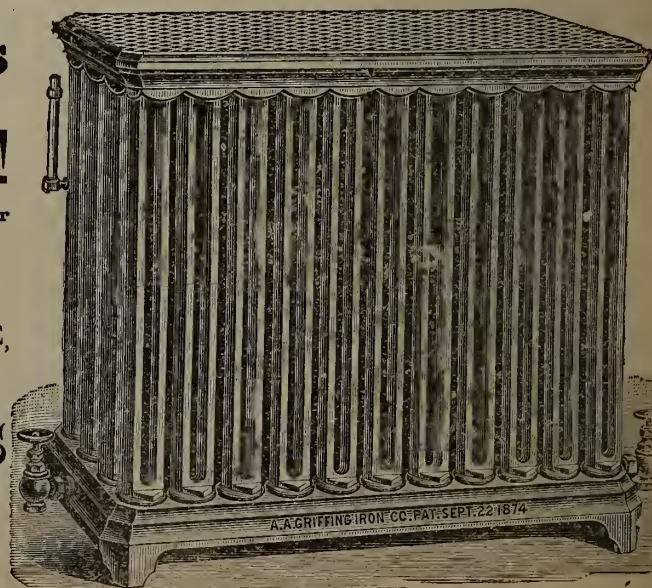
Guaranteed more Economical than any other
Heater now made, and containing every
known Improvement in Hot
Water Heating.

STEAM FITTINGS, CAST IRON PIPE,
REGISTER, GRATES, ETC.

HOT AIR FURNACES

FOR COAL OR WOOD.

E. & C. GURNEY & CO.,
MONTREAL.



Bundy Radiators for Quick Circulation and Economy of Space.

CHEMICAL APPARATUS! OF EVERY DESCRIPTION.



Glass, Porcelain, Stoneware, Platinum Crucibles of every sort, Analytical Scales and Weights, Fine Chemicals and Reagents, including Volumetric Solutions. Every requisite for Analysis or Experiment. For Sale by

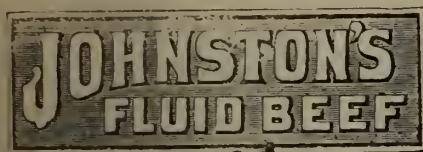
LYMAN, SONS & CO.,
384 St. Paul St., Montreal.

Illustrated Catalogue mailed on receipt of 10c. or Business Card.

Boiler For Sale.

AN EIGHTY H.P. TUBULAR STEEL BOILER made by W. C. White, Montreal, 15 ft. x 5 ft. 4 in. —eighty 3½ in. tubes; smoke stack 45 ft. long; guyards and guys. Very little used. Equal to new. Price on cars, \$600. Address

P. O. Box 6,
MONTREAL.



A PERFECT FOOD

This statement is made upon the results of scientific analyses by the best chemists in the world. FRANCIS WYATT, Ph. D., Analytical Chemist, New York, after giving an exhaustive analysis, says:—"Here we have the whole of the elements, without a single exception, necessary for the formation of flesh, muscle and bone."

JOHNSTON'S FLUID BEEF

Is not a mere meat extract or a concentrated decoction, but simply fluid beef, containing, besides the albuminoids and gelatinoids, the correct proportion of those phosphates so essential to the support of life."

Victor Electric Fuses.

Superior to all others for Exploding any make of Dynamite, High Explosives, or Gelatine Powder. Each Fuse is tested and warranted extra strong and waterproof. Low grades of Dynamite Powder will do ten per cent. more execution if detonated with Victor Electric Fuses.

VICTOR BLASTING MACHINES.

Latest improvements, made in three sizes, easy to operate, strong and durable. No expensive repairs, low in price, will fire any make of Electric Fuses.

MANUFACTURED ONLY BY

JAMES MACBETH & CO.,

123 Maiden Lane, N.Y., U.S.A.

Send for Catalogue.

FOR SALE.

A COAL MINE IN CAPE BRETON,

Area, 970 acres, underlain by 6 or 7 beds of the best Coal in Nova Scotia. The property is estimated to contain from 50 to 60 million tons of Coal. No Coal Mine can be more easily or cheaply operated. The angle of dip is 6 degrees, and the rock stratification is remarkably even and without fault or break.

Apply to

ALEXANDER CAMPBELL,
Annapolis Royal, N.S.

EDMUND C. SHOREY, M.A.,

Analytical Chemist,

FOOT OF PRINCESS STREET } - - KINGSTON.

MINERALS OF ALL KINDS assayed at reasonable rates. Analyses of Milk, Water, &c.

PHOSPHATES A SPECIALTY.

D. McEWEN & SON,

Machine, Engine & Boiler Works

(Established January, 1868)

Compound and Yacht Engines a Specialty. Estimates for Steamboats complete.

MINING REPAIRS CONSTANTLY ON HAND.

WORKS AND OFFICE:

54 to 60 Queen Street, Kingston, Ont.

ASBESTOS.

THEO. HAMEL,

44 Mountain Hill, Quebec,

SOLE ASBESTOS MANUFACTURER in CANADA

Write for prices and catalogue. Use Asbestos and save your money. Applied on boilers and Steam pipes it will prevent them from rusting and will economize 33% on fuel.

Canadian Syndicate Limited.— This syndicate was registered in London on the 3rd inst., with a capital of £20,000, in £1 shares, 200 being founders' shares, to acquire lands and heritages, coal, iron and other mines and industrial properties in Canada. The number of directors is not to be less than two nor more than five; the subscribers are to nominate the first; qualification, 100 shares; remuneration, £200 per annum and five per cent. on any dividend, to be divided as they may determine.

Powdered Coal in Place of Natural Gas.—Erastus Wiman and others are experimenting with a new process of heating iron with powdered coal instead of natural gas. The experiments are being conducted at the Vesuvius Iron Works, Pittsburg, and are said to be satisfactory. Speaking of the test, Mr. Wiman said: "It is yet rather limited in its scope, but eminently satisfactory in its results. One heat consumed 684 pounds of pulverized coal. The quantity of iron heated by that quantity of fuel was 4,600 lbs. We are confident, from the present results, that we can heat iron at 50c. per ton, including the cost of pulverized coal, while the existing rates for natural gas at the different mills make the cost of heating iron upwards of \$1 per ton. While a contrast test was not attempted, the lack of facilities necessary for the perfect operation of the new experiment rendered the test successful in only a limited degree, but sufficient to prove that we can produce the same quantity of iron with the pulverized coal process in an hour as the natural gas facilities at present afforded can produce in two hours. Of course, while the tests thus far have proven satisfactory, unforeseen difficulties may arise in the future, although we feel confident of success in a very short time." The tests will be continued in order to remove all doubts as to the success or failure of the plan.

ALEX. RANKIN,

20 Toronto Street, Toronto Ont.

Agent for sale of Mines and Mineral Lands.

CORRESPONDENCE SOLICITED.

Agents in England and New York.

E. H. SARGENT & CO.,

IMPORTERS AND DEALERS IN

ASSAYER'S MATERIALS,

Chemicals and Laboratory Supplies.

125 State Street,

CHICAGO.

HARRIS & CAMPBELL

Latest Designs in Drawingroom, Diningroom and Bedroom

FURNITURE

With improved Steam Machinery our facilities for manufacturing Cabinet Goods are complete. Our upholstery Department is well stocked with latest imported patterns.

Corner **QUEEN & O'CONNOR Sts.**
OTTAWA.

THIS YEAR'S

MYRTLE

CUT AND PLUG

Smoking Tobacco

FINER THAN EVER.

SEE

T & B

In Bronze on Each Plug and Package.

THE DOMINION

SAFETY BOILER CO.

MANUFACTURERS OF

The "Field-Stirling" Patent High Pressure Boiler,

The Safest and Cheapest Steam-Generator now in Use.

This Boiler is unusually durable, being made of the best steel and wrought iron exclusively. No cast-iron is employed. It is simple in construction, has a rapid, well-defined circulation, and a large cool mud-drum, where all impurities are collected to be blown off. All parts of the boiler are readily accessible for the closest inspection. It has great excess of strength and is not liable to be strained by unequal expansion. The water space is divided into sections so arranged that NO EXPLOSION IS POSSIBLE.

Some of Our Leading Customers:

The J. A. Converse Mfg. Co. (A. W. Morris & Bro.), Montreal; The Canada Sugar Refining Co., Montreal; The Pillow and Hersey Mfg., Montreal; The Berthier Beet Root Sugar Co., Berthier, Que.; The Imperial Insurance Co., Montreal; The Massey Manufacturing Co., Toronto; The Acadia Coal Co. (Ld.), Stellarton, N.S.; Canada Paper Co., Windsor Mills, Que.; Royal Electric Co. (Central Station), Montreal; Dodge Wood Split Pulley Co., Toronto, and a repeat order from A. W. Morris & Bro., after five months' experience; Ingersoll Rock Drill Co. of Canada.

We guarantee Dry Steam and Great Economy of Fuel. Correspondence Solicited.

J. FRASER TORRANCE, M.E.,

P.O. Box 1707, Montreal.

Manager.

If you want

BAGS

FOR PACKING

ASBESTOS, PHOSPHATES, ORES, &c.,

Send to us for Samples and Prices.

Every quality and size in stock.

Specially strong sewing for heavy materials.

Lowest prices compatible with good work.

We now supply most of the Mining Companies, and those who have not bought from us would find it to their advantage to do so.

THE CANADA JUTE COMPANY (LTD.)

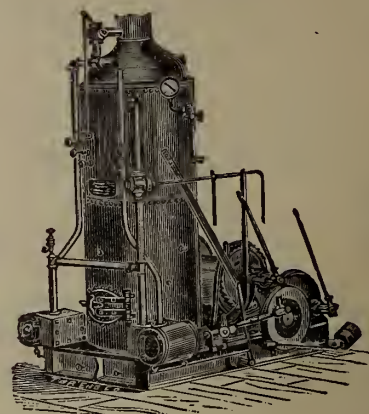
17, 19 & 21 ST. MARTIN STREET,

Established 1882.

MONTREAL.

M. BEATTY & SONS,

WELLAND, ONT.



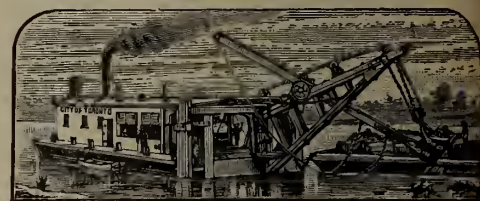
HOISTING
ENGINES

ENGINES
FOR
Mines
AND
Inclines

Horse-Power Hoisters,

Stone Derrick Irons,

Centrifugal Pumps.



DREDGES,

DERRICKS,

STEAM SHOVELS,

And other Contractors' Plant.

AMALGAMATING MACHINERY.

Stamp Mills for Wet or Dry Crushing. Huntington Centrifugal Quartz Mill. Drying Cylinders. Amalgamating Pans, Settlers, Agitators and Concentrators. Retorts, Bullion and Ingot Moulds, Conveyors, Elevators, Bruckners and Howell's Improved White's Roasting Furnaces, Etc.

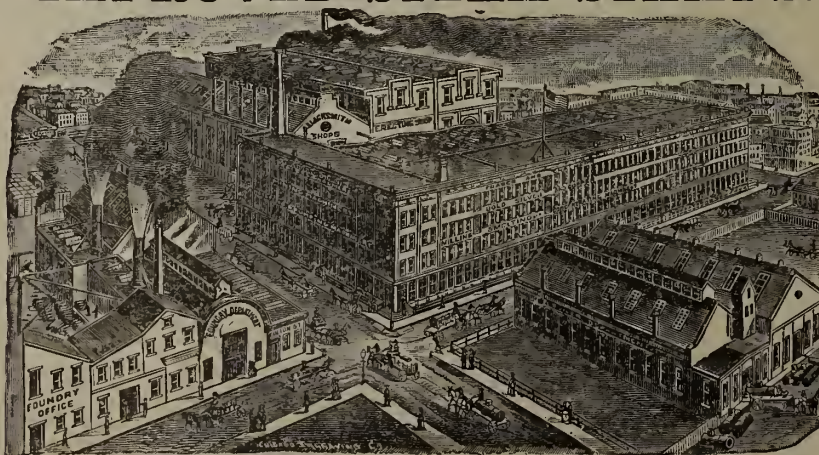
CONCENTRATING MACHINERY.

Blake, Dodge and Comet Crushers, Cornish Crushing and Finishing Rolls, Hartz Plunger and Collom Jigs. Frue Vanner & Embrey Concentrators, Evans', Calumet, Collom's and Rittenger's Slime Tables. Trommels, Wire Cloth and Punched Plates. Ore Sample Grinders and Heberle Mills.

FRASER & CHALMERS, MINING * MACHINERY.

Improved Corliss and Slide-Valve Steam Engines,
Boilers--Horizontal, Vertical and Sectional,
IMPROVED STEAM STAMPS.

Holisting Engines, Safety Cages,
Safety Hooks,
Ore Cars, Water and Ore Buckets,
Air Compressors, Rock Drills, Etc.
General Mill and Mining
Supplies, Etc.



Pumping Engines and Cornish
Pumping Machinery,
Improved Water Jacket
Blast Furnaces for Calena and
Copper Ores.
Slag Cars and Pots,
Roots & Baker Pressure Blowers,
Suspended Tramways.

Sectional Machinery for Mule-Back Transportation.

General Offices and Works: FULTON & UNION STS., CHICAGO, ILL.

BRANCH OFFICES: NEW YORK, Room 43, No. 2 Wall St. DENVER, COLO., 1316 Eighteenth St. SALT LAKE CITY, UTAH, 7 West Second South St. LONDON, ENGLAND, 23 Bucklersbury, E. C. CHIHUAHUA CITY, MEXICO, No. 11 Calle de Juarez. LIMA, PERU, South America. JOHANNESBURG, TRANSVAAL, South Africa.

Sole Western Agents for TYLER WIRE WORKS Double Crimped Mining Cloths.

The Canadian Mining Review

CONDUCTED BY . . . B. T. A. BELL

OFFICES:

UNION CHAMBERS, 14 Metcalfe St.

OTTAWA.

Vol. VIII. AUGUST, 1889. No. 8.

Tenure of Nova Scotia Mineral Lands.

The policy of the Province of Nova Scotia with regard to its mineral resources has been somewhat different from that adopted in other parts of the Dominion, and it has many points recommending it to the attention of the mining public, as well as to the Crown Land Departments of the Local Governments. Here the interests of the individual have been consulted equally with those of the government which derives an important revenue from Crown minerals.

The early land grants were made to three classes of people—Individual Settlers, Emigrants arriving in a body, and receiving through Commissioners, lots included in one grant or patent sometimes covering 125,000 acres; and wealthy individuals who were able by money or influence to secure grants sometimes as large as 20,000 acres. The names of men prominent in the early history of the country in this way became attached to numerous localities, as in the case of the DesBarres, Wilkins, Wentworth, Franklyn and other grants.

Land grants made previous to 1759 do not appear to have had any minerals reserved to the Crown, unless perhaps the royal metals were reserved even if not specifically mentioned. After this date usually gold, silver, precious stones, *Lapis Lazuli* were reserved, and after 1764, lead, copper and coal were added to the list. In some large grants, however, aggregating several millions of acres, made about this time only gold, silver and coals were reserved. After the year 1809, iron was added to the list of reserved minerals. The importance of reserving the coal in Cape Breton was recognized at an early date. In 1784 when the Island was first created into a separate province upon the recommendation of Governor DesBarres, an Order-in-Council was passed at St James, that in all grants of land a reservation should be made "of all coals, and mines of gold, silver, copper and lead which may be discovered in such lands."

In 1825, George the Fourth, by an exercise of the royal prerogative, gave his brother, the Duke of York, a lease of all the reserved minerals of the Province (including Cape Breton) for sixty years. However, in 1853, arrangements were made by which this lease was terminated on conditions advantageous both to the Province and to those holding under the Duke of York's lease. By an Act passed in the last named year, the Province relinquished

to the land grantees all the minerals previously reserved except gold, silver, lead, copper, iron, tin, coal and precious stones, and all other minerals, including limestone, gypsum, slate, clay, etc., are the property of the grantees. And all grants since that date have been in uniformity with that statute.

Two minerals only of importance have since been discovered and worked, viz., antimony and manganese ores, which, under the Act, are the property of the owner of the soil and pay no royalty. As large areas of Laurentian rocks are known in Cape Breton, it is possible that phosphate may be added to the list of fee simple minerals. From the standpoint of the Provincial revenue, it is to be regretted that iron ore was not reserved at an earlier date, as many of the large township grants in the Annapolis Valley, Cobequid Mountains, and elsewhere, contain important deposits of this metal, which have been largely worked at Londonderry.

The principle adopted with respect to these reserved minerals over one hundred years ago—that of never selling, but only leasing on short renewable terms—has been steadily maintained. The fact that this policy was adhered to at times when influence and favoritism ruled the day, may have been due to the custom adopted in England of letting the Crown minerals on royalties. The early lettings of coal in the Province were on short terms, from two to six years, at exorbitant royalties, sometimes as high as a dollar per Chaldron.

Upon the termination of the Duke of York's lease in 1858, when the mineral lands were thrown open, it was decided that licenses to search for minerals other than gold covering five square miles should be granted; out of which, within one year, an area of one square mile could be selected for mining. Upon the commencement of effective mining operations, the licensee was entitled to a lease for twenty years, renewable three times, provided that at the end of each term he was mining and complying with the conditions of his lease. Leases of gold areas are for a term of twenty-one years, and many contain any number of areas 150 by 250 feet; and as they are laid off in regular ranges, no ground is lost by the Government, and the individual miners' boundaries are readily ascertainable. In the same manner, the coal areas present regular outlines, a matter of importance, as coal can be mined in larger quantities, and more cheaply, than from the seams lying under fee simple properties, presenting every irregularity of boundary. The adoption of the principle of having the boundaries prolonged vertically on all sides of the leases frees the miner from the "law of the apex" and the inevitable crop of lawsuits, so prominent a feature of precious metal mining in the United States.

In order to facilitate business, the Nova Scotia Mines Department has been made a court of registry of all titles, transfers, etc., of leases and licenses of Crown minerals, free of cost. Any transfer, etc., of mining title in any part of

the Province is registered at the Departmental office, and is equivalent to the county registration, as in the case of land titles. The Crown having reserved the minerals, has secured to all lessees the right of taking land for the purpose of mining; failing a friendly agreement with the owner of the soil, the miner can obtain by arbitration the surface soil necessary for his works. At present revenue is received only from coal and gold. In the case of the former, sworn quarterly returns are made by the lessee of the amounts of mineral sold and of the labor performed. In the case of the gold mines, licenses are issued to parties building quartz mills, who are placed under bonds to place royalty on all the gold they extract. While the lessees make sworn returns direct to the Department of his labor and the number of tons sent to the mills.

When the monopoly of the Duke's lease ceased in 1858, and the coal lands were opened to the public, it was considered that leases should contain as conditions a royalty of about 10 cents on every ton of round coal sold, and stipulations for effective and continuous working, a non-compliance with which rendered a lease liable to summary forfeiture. The lessee of a gold ore was, under like penalties, required to perform annually a certain number of days' labor.

Practically speaking, no government could deal in so summary a manner with defaults in carrying out the lease conditions to the letter, as many extenuating circumstances could be alleged, such as fluctuations in trade, litigation, etc. Nor could the Mines Department be allowed to exercise a discretion as to cancellation of leases, as those aggrieved by its decisions would be ready to complain of harsh treatment. The remedy for the difficulty was the admission of the general public as a party of the third part, and for many years forfeitures have been made acceding to a prescribed procedure in the requisition of any person desiring possession of an area not being worked. The government of course reserving its right to act of its own motion in questions of royalty, etc. At another time it may be pointed out how this system worked, though steps have been taken to prevent harassing forfeitures, and to maintain a balance between legitimate mining and speculation.

The Ottawa and Gatineau Valley Railway.

An enterprise of no secondary importance has now taken practical shape, is about to proceed, and will be prosecuted energetically. We refer to the Ottawa and Gatineau Valley Railway, a line which commences south of the Gatineau railway bridge, and proceeds along the river to the well-known Gilmour mills at Chelsea; thence to the Pêche, still hugging the water course; thence to Kasabazua, and on to the Desert. The Gatineau Valley road has had a

hard struggle, but now, with a cash bonus of \$10,400 per mile and 6,000 acres of land per mile, there will be no trouble found in financing it. The subsidies given by the Dominion and Provincial Governments are a fair criterion of the public estimation in which this railway is held; it is an acknowledgment of its utility and advantages. The line will open up a great mineral, agricultural and timber country, and prove a source of great convenience to the traveling community, as up to the present time the old stage coach has to do what modern appliances perform with so much more speed and acceptability. We look to new life and an era of marvellous progress along the Gatinco so soon as the line is completed. The President is Mr. H. J. Beemer, of Montreal, and the Vice-President, Mr. C. H. MacIntosh, of Ottawa.

Artificial Fertilizers.

By Francis Wyatt, Ph. D.

Chemistry may be described as that branch of science which investigates into the nature and properties of the elements of matter, and determines the manner in which they react upon, and combine with each other. If we hand over a grain of wheat to the botanist, he can discern in it nothing but a tiny, yellow, opaque and brittle seed, whereas, if we pass it to the chemist, he will discover by analysis that it is composed of a woody fibre, starch, gum, sugar, fat and protein. Again; ask a geologist to examine the soil, and he will designate the different ages to which it belongs and the various rocks from which it is derived, but, without the chemist, he is unable to determine the nature of its constituents, and hence cannot foretell, before any cultivation has been attempted, whether it is destined to be fertile, or of what kind of vegetation it is best able to promote the growth.

The application of chemistry to agriculture is thus naturally indicated; by its aid we obtain from the soil, from plants and from animals, at the lowest possible expenditure of time and money, the highest possible quantity of those substances indispensable to our physical well-being.

Production, in order to be cheap, must be rapid and plentiful, and we all know that the progress of unaided nature is methodical and slow.

Chemistry, by investigating the natural laws which govern the development of all living things, and by carefully observing the facts acquired by the practical experience of centuries, endeavours to provide the farmer with means by which he may assist and hasten the processes of nature. His work is, of course, still far from complete, but it has familiarized us with those elements which are essential to plant growth, taught us how those elements are distributed, shewn us what portion of them is or should be contained in our soils, and what soils are most propitious for different kinds of plants.

When our globe was launched into space, it was a liquid somewhat similar in consistency to molten glass, and, therefore, presented a vastly different appearance to that with which we are acquainted. It was made up of about sixty elementary bodies, so deposited, by order of weight or density, that the heaviest, such as gold, silver, lead and copper, were in the centre, while the lighter, such as calcium, aluminum and silicon, remained, and still exist, near the surface, where they have combined to form clays, limestones and sands.

Encircling its interior was a heavy, poisonous atmosphere, comprising all those elements which at a very high temperature assume the gaseous form—notably sulphurous, sulphuric, phosphoric, hydrochloric, nitric, boric and carbonic acids, with torrents of steam, and dense clouds of mercurial, antimonial, arsenical and other metallic vapors. When this mass began to cool, it probably resembled an immense glass ball, the solidified sides of which were uplifted by the bubbleings of the intensely hot liquid mass within. These solid projections formed our mountains, and, passing from the transparent to the opaque, they gradually assumed the crystalline form. What is known as the earth's crust must have resulted from an extraordinarily forcible action consequent upon the fall of temperature. The vapors already alluded to were condensed into rain. The rain dissolved all the acid bodies, and these acids, attacking the alkaline crust, combined with its most powerful bases to form various salts. These salts soon underwent decomposition; some—such as sulphate of lime or gypsum—were deposited, while others, principally the chlorides, remained in solution and formed the seas. The neutralization of the stronger and more corrosive acids permitted the weaker carbonic acid to develop its activity, and it is this acid which has continued to play the most important part in nature in our own times. Held in solution by the running waters, it attacked and dissolved the various bases which existed in such large quantities in the mountains, and deposited them in the form of carbonates in the still warm valleys. This process of saturation, or neutralization, being entirely accomplished, chemical equilibrium may be said to have become established; the period of great geological catastrophes, therefore, came to an end, and the temperature of the earth gradually sank below the boiling point. A few volcanic disturbances continued, it is true, to occasionally convulse it; there was the upheaval, splitting asunder and complete overthrow of the most gigantic mountains, the drying up and the division of seas, and the formation of lakes of both fresh and salt water. As the temperature continued to cool, however, these disturbances became more and more rare, and there then commenced that formation of the soil which gave rise to the phenomena of vegetation.

VARIETIES OF SOIL.

It is the general custom to class arable lands according to the nature of their predominating

constituents, and thus we allude to soils as sandy, clayey and limey.

Sandy soils are distinguished by their extreme porosity, and are frequently in such a fine state of division, that in the dry season the least wind will displace and scatter them in all directions. In such cases they are naturally sterile; but, when they are sufficiently moist, they facilitate and encourage the growth of an immense variety of plants of the lower order, which, by their eventual decomposition or putrefaction, form considerable deposits of that valuable substance called humus.

Such soils are more propitious than any others for the development of plants with very delicate or fine roots, such as barley, rye, oats, lucern, lupins, lentils and potatoes; but they require constant attention, and a large and regular quantity of manure, because their porosity permits them to absorb such an abundance of oxygen, that all their organic matter is rapidly burnt up.

Clayey soils are heavy and compact, and, when they contain more than fifty per cent. of pure clay, are onerous to work, and unprofitable to cultivate. It has, however, fortunately been discovered that the addition to them of so small a quantity as two per cent. of burnt lime suffices to so entirely change their nature and consistency, by transforming the silicate of alumina into a porous silicate and aluminate of lime, that it is now an easy matter in districts where lime is cheap and plentiful, to overcome this difficulty. In hot countries or in windy regions or in districts where the sub-soil is of a very permeable character, good clay lands offer great advantages, and although they periodically require the application of large quantities of reconstituents, they possess the faculty of retaining all the precious elements supplied to them, and of storing them up for the use of successive crops. When they contain a proportion of about ten per cent. of carbonate of lime, or chalk, they are the best of all soils for the extensive growth of such important plants as wheat, corn, clover, hemp, peas and beans, and of such trees as the chestnut and the oak.

Limey, or purely calcareous, are even lighter than sandy soils, and when, as is sometimes the case, they are very white and dry, they are absolutely barren. Such as these are, however, easily encountered, for we generally find them mixed with a sufficiency of clay to give them some degree of consistency, and render them available for ordinary purposes. Few soils are entirely devoid of lime, owing to the fact that all rocks contain it in greater or lesser proportion, and because it is transported in immense quantities by waters, in the form of bi-carbonate, and deposited. If it were otherwise, or if, in the absence of lime, other alkaline substances were not forthcoming, the acid principles secreted by all plants could not be saturated, and the inevitable result would be decomposi-

tion and death. In its pure form, however, lime is such an extremely strong base, that it is incompatible with life, and hence it is never allowed to exist in the soil, unless it be combined either with carbonic or silicic, or sometimes with sulphuric and nitric acids.

The general properties of every variety of soil are much influenced by colour; those which are white, and hence unable to absorb the solar rays, being invariably cold, whereas those which are dark are warm and fertile. In this regard both iron and manganese are of undisputed value, for by their transformation into ferric and manganic oxides, they produce the deep red or brown so much admired by sagacious farmers. In damp climates or in very moist soils, however, too much iron is apt to become a source of considerable danger, from the fact that, by the exclusion of air, the ferric is reduced, by its affinity for water, into ferrous oxide, and in that form exercises a highly corrosive action on vegetable life.

ELEMENTS OF PLANT LIFE.

Sixty years ago there was no such thing as what we now call scientific agriculture. In the old countries men were asking themselves the very question that faces us to day—how it is that lands which were once so fertile and productive now show signs of approaching exhaustion. The answer to this question could only be given after we had found how out-door plants live, whence they obtain their food, of what elements that food is composed; how it is conveyed to the plants and how they absorb it into their organisms. In point of fact the manner of life in plants is very similar to the manner of life in animals and man. They require certain foods in stated proportions which pass through the process of digestion; they must breathe a certain atmosphere and they are subject to the influences of heat and cold, light and darkness.

The tissues of their bodies, like ours, are composed of carbon, hydrogen and oxygen, and contain besides nitrogenous principles, certain minerals, such as phosphoric acid, lime, potash, sulphur, magnesia and iron. It will be seen at once that if it is necessary for us to constantly absorb a sufficiency of these self-same elements to keep up our normal heat and provide us with new tissue, it must be no less essential for plants to acquire similar food, for similar purposes.

Pure atmospheric air is a mixture of nitrogen and oxygen, with a small proportion of aqueous vapor, and about 4-10,000th of carbonic acid, while water is formed by the combination of two parts of hydrogen and one part of oxygen. It is therefore apparent that the principal organic elements of plant food exist in the atmosphere as air, water and charcoal, and may be absorbed from without by the leaves, while the whole of the mineral bodies in order to be found in the soil, should be taken up from within by the roots.

How plants absorb and elaborate the inorganic matter necessary to the food of those graminiferæ which afford to man the bulk of

his animal sustenance, or what process is undergone in the assimilation of carbon, hydrogen, oxygen, and nitrogen, which, in the form of carbonic acid, water and ammonia, or nitric acid, are taken from the air and the soil, we have no space to discuss; but, it will be interesting to quote a very beautiful and practical illustration of the contrast between them and ourselves, furnished by Dumas.

Vegetables.	Man and Animals.
Decompose Produce.	Consume
{ Nitrogenous Matter, Fatty Matters, Gum, Sugar, Starch.	{ Nitrogenous Matter, Fatty Matters, Gum, Sugar, Starch.
{ Carbonic Acid, Water, Ammonia.	{ Carbonic Acid, Water, Ammonia.
Evolve oxygen, constitute apparatus of reduction and are stationary.	Absorb, oxygen, constitute apparatus of oxidation and are locomotive.

The consideration of this remarkable contrast leads us to contemplate the progressive exhaustion of the soil, and the necessity for its reconstitution by the aid of chemistry, for, while admitting that *we produce those very elements* which the plants decompose, and which are so necessary to their existence, it is nevertheless a fact that *we are locomotives, and do not in practice give back to them what we have taken away.*

The elementary composition of plants being thus determined, the next step that suggested itself to investigators was the analysis of the soil, in order that comparisons might be established between virgin lands which had borne no cultivated crops and old soils which had long been tributaries to every kind of vegetable culture.

Briefly stated, it was found that good, ordinary young lands, contain in abundance most of the dominating ingredients discovered in plant organisms, and that soils which have long been under cultivation, and now show themselves incapable of their former remunerating production, only contain these dominants in minute proportions, or lack them altogether.

These data form the basis of our present science, and may be summed up in the following manner:

A. Plants require for their nourishment and prosperity a given quantity of food, composed in varying proportions and according to their different natures, of hydrogen, oxygen, nitrogen and carbon, and of phosphates, sulphates and chlorides.

B. The hydrogen and oxygen, in the form of rain or dew, are supplied as water, and the carbonic acid is mainly derived from the air.

C. Good virgin soils contain the whole of the necessary minerals, in addition to considerable quantities of nitrogenous and carbonaceous matter.

D.—Long-cultivated and non-productive soils may be termed exhausted, since chemical analysis proves their inability to furnish the needful substances in quantities equal to those found in the ashes of healthy plants,

FERTILIZERS AND AMENDMENTS.

Having arrived at this important stage of progress we understand that, if agriculture is to continue to be the basis of national wealth and prosperity we must find means of restoring to our soils, if not in a natural in some artificial form, the chief elements yearly taken away from it by our crops—we say *chief* elements because a great number of the necessary minerals are only required in very minute proportions, and therefore generally exist in sufficient abundance. We may consequently disregard all these, and devote our attention to nitrogen, potash, phosphoric acid and lime, since these not only play the most important part in the functions of vegetation but are the most liable to complete exhaustion. The following figures representing averages compiled from the official reports of the United States Department of Agriculture extending over a series of years, will be found very *à propos* for the purpose of illustrating the arguments already put forth.

ELEMENTS OF FERTILITY TAKEN FROM THE SOIL PER ACRE AND PER ANNUM, IN POUNDS.

—	Nitrogen.	Lime.	Phosphoric Acid.	Potash.
Wheat	25	15	30	45
Maize	55	45	80	40
Oats	30	14	18	20
Barley	35	12	18	20
Rye	25	13	25	35
Buckwheat	35	12	40	38
Hay	40	40	15	40
Tobacco	not calc'd.	160	not calc'd.	340
Turnips	do	100	45	150
Potatoes	44	60	52	185

These are, of course, only a few examples, but they will suffice for present purposes, and it is perhaps hardly necessary to add that if, according to the nature of the crop desired, at least a sufficient proportion of each of these essential elements be not present in the soil, the plants will languish, various malignant diseases will declare themselves, and death will inevitably ensue before they reach maturity.

Now, the practical question that must naturally arise, is, how may all this loss be repaired, and whence are all the elements needed to repair it to be derived? It is not so very long ago since this question would have been generally answered by the words, "farm-yard manures," and even to-day there are a large majority of farmers who depend exclusively upon this valuable fertilizer.

The fallacy of their policy is, however, made apparent by a simple calculation, which any interested reader can work out for himself, in this wise.

The necessary elements to the growth of a medium crop of hay have been put down, approximately, per acre, as:—

Nitrogen	40 pounds.
Lime	40 "
Potash	40 "
Phosphoric acid	15 "

The very best farm yard manure is found to contain, on an average, for every hundred pounds, exclusive of water and fibre :—

Nitrogen.....	not quite $\frac{1}{2}$	pound.
Lime.....	little more than $\frac{1}{2}$	"
Potash.....	about $\frac{1}{2}$	"
Phosphoric acid.....	(say) $\frac{1}{4}$	"

With a very moderate allowance for loss in storage, drainings, evaporations, etc., it must be conceded from these figures that to repay what has been borrowed from the soil by a single crop of hay would call for some six tons of material per acre; and there is probably only a very limited number of farmers—even if there are any—who could produce anything like this quantity. The practical answer to the question propounded, therefore, is that we must profit by the teachings of science and turn to artificial or chemical fertilizers as the only means of avoiding present loss and eventual poverty. This leads to a brief glance at the most accessible materials, and the forms in which they are most appropriate for the requirements of growing plants.

NITROGEN.

The sources and the supplies of nitrogenous elements, outside the free nitrogen and the ammonia that exist in the atmosphere, are numerous and plentiful. Every species of plant, roots, stalks, leaves and seeds yield it up in varying proportions, under the influence of decay. The refuse or waste from an average crop of clover contains about fifteen pounds of assimilable nitrogen per acre, and some of the other green crops are so rich in this element that it has become customary to occasionally grow them for the express purpose of plowing them under directly they have reached maturity. Outside the farm, we have guano, fish, wool rags, horns, hoofs, hair, blood and all other animal refuse from the slaughter-house, and, failing a sufficiency of all or any of these, there are the nitrates of soda and potash, and sulphate of ammonia.

The following are about the proportions of nitrogen contained in every 100 pounds of some of the foregoing materials :—

100 lbs. shoddy	contain	7 lbs. nitrogen.
100 " wool dust	"	9½ "
100 " dried blood	"	12 "
100 " rope cake	"	5 "
100 " cotton	"	5½ "
100 " sugar scum	"	3 "
100 " leather cuttings	"	8 "
100 " sul. ammonia	"	21¼ "
100 " nitrate of potash	"	13¾ "
100 " " soda	"	16½ "

POTASH.

We have seen that the quantity of potash absorbed by the most important of our crops is greatly in excess of phosphoric acid. It may consequently be assumed that continued fertility depends upon a preponderance of this important base. This, nature has in a great measure provided for, by promoting the continuous decomposition of feldspathic and other rocks, and by favouring the transfer of potash in the various forms of silicates, carbonates, and oxides from the subsoil to the surface.

When all these varieties fail, however, it is easy to secure inexhaustible supplies from the nitrates and chlorides, which are either deposited in various localities on the surface, or in the interior of the earth's crust, or held in solution by the waters of the sea.

Potash salts, to be readily assimilable, or useful to the plant, must be liable when introduced into its sap, to so easy a decomposition, that their liberated alkali may enter at once into the necessary combination with the organic compounds.

If, as it is applied, the potash be united to its acid by too strong a bond, the vegetable will be unable to effect a dissociation; and the salts will accumulate in the tissues, and become a mere burden instead of promoting healthy growth.

This question of assimilation, therefore, is one that demands very attentive study; and it is from the data collected by the most recent scientific discoveries in relation to the laws and powers of affinity, that the various salts, according to their adaptability, have been classed in the following order :

Carbonate,	Sulphate,
Nitrate,	Chlorides.

The amount of potash contained, in round figures, in each of these salts when pure is as follows :

100 pounds Carbonate contains 68 pounds of potash.

100 pounds Nitrate contains 46½ pounds of potash.

100 pounds Sulphate contains 54 pounds of potash.

With regard to the chlorides, which are compounds of chlorine and *potassium*, it is necessary before they can furnish anything available that they should undergo a preliminary decomposition in the soil, but it may be assumed that when this has taken place, every 100 pounds of the pure chloride would be equal to about 63 pounds of potash.

On the assumption that neither the sulphate of potash, nor the chloride of potassium is directly assimilable by plants, their efficacy must depend upon the composition of the soil under treatment, and the character of any other fertilizers with which they are simultaneously used.

To illustrate this it is only necessary to imagine a mixed fertilizer containing in suitable proportions, superphosphate of lime, sulphate of ammonia, and muriate of potash.

As soon as this compound reaches the soil, a reaction is commenced between the whole of the salts, resulting in the production of phosphates of ammonium and potassium, and sulphate and chloride of calcium.

The two latter will be washed down into the subsoil by the rains and carried away, while the two first will enter the roots, and be very readily decomposed in the sap, and utilized by the plant.

If, instead of the above, a mixture be chosen of nitrate of soda, and either the muriate or the

sulphate of potash, a similar transformation will take place; chloride or sulphate of sodium being produced on the one hand, and nitrate of potash on the other.

Dispensing with unnecessary reiteration, these typical examples sufficiently illustrate the importance and advisability of making preliminary trials upon a small scale, with each salt, in every case where the use of potash has been determined upon, since, under the varying influences of the different elements in every soil, uncertain and unlooked-for results may be obtained.

PHOSPHORIC ACID.

This indispensable fertilizing agent is probably the one in which all cultivated soils are most deficient, and, to make matters still more complicated, its occurrence though so plentiful in nature, is found to be most unequal.

It does not exist in the atmosphere; soils of the granitic and tertiary formations are nearly deprived of it; and many other species only contain it in very slight traces.

The following are the principal and most available commercial sources of phosphates for agricultural purposes, viz.:

First, Natural phosphates, of animal or mineral origin, such as bones, bone-ash, and apatites very finely ground.

Second, Superphosphates, manufactured by treating these raw materials with a sufficient quantity of sulphuric acid to transform them from an insoluble into a soluble form.

Third, Precipitated phosphates, obtained by dissolving raw phosphates in hydrochloric instead of sulphuric acid, and adding to the liquid a milk of lime.

From which of these forms the most direct advantage is to be obtained by the farmer, is a somewhat disputed question. Accepting the generally admitted and rational theory, that no element can penetrate into the interior of a plant unless it be in the form of solution, it naturally follows that preference will be invariably given to those commercial phosphates which are most readily subject to dissociation; and this will entirely depend upon two conditions :

(a) Their own degree of aggregation.

(b) The nature and composition of the soil in which they are employed.

The first thing to be obtained is undoubtedly a fineness of pulverization, which will so divide the molecules as to render them easily decomposable by the natural action of the elements contained in the ground, and in this only partial success has been achieved by mechanical means. So long ago as 1851, Leibig recognized the difficulty, and proposed, in order to solve it, to chemically perform this operation by manufacturing superphosphates.

From the standpoint of disintegration, this method has been entirely satisfactory, and has enabled agriculture to rapidly obtain results from the use of phosphoric acid, which would otherwise have been impossible. From a chemical point of view, however, the whole

theory fails. We know that superphosphates are only soluble in water so long as the sulphuric acid with which they have been manufactured retains its ascendancy over the lime, and that when they reach the soil, especially where carbonates are in abundance, the sulphuric acid is at once overpowered. The phosphoric acid, being unable to exist in a free state is taken up by the lime and iron and at once reverted to a tribasic form. In other words the whole question is one of time, and of dollars and cents.

The farmer buys a ton of raw phosphatic material finely ground, and containing say twenty-five per cent of phosphoric acid for \$10. If his land contains neither humus nor acid elements, nor a sufficiency of lime, the phosphate will not decompose and he will have to wait perhaps several years before obtaining any appreciable results for his outlay. On the other hand he buys a ton of superphosphates, containing only fourteen per cent. of phosphoric acid for \$20 and applying it to an exhausted soil, producing the desired results on his very next crop. Hence it is apparent that the phosphoric acid of the latter is more assimilable than that of the former case; and this assimilability can only be due to the absolute state of division insured by the series of decompositions to which the raw phosphate is exposed during the manufacturing process. To define with scientific accuracy the exact merit or intrinsic value of any specific phosphate, is a matter of very serious difficulty; since, besides that of its own physical conditions, so much depends upon the nature and composition of the soil in which it is to be employed. No better examples of this truth could possibly be found than the preliminary comparative experiments, conducted during the past two years, with raw basic slag, and various other phosphatic materials; for they have so far proved, that whereas, in some soils the effects produced by crude phosphates fairly rival those obtained with superphosphates, in other soils they are either quite inert or insignificant in their action.

LIME.

All farmers are familiar with the use of lime, but it is doubtful whether many of them know the exact reasons for its application or clearly understand its influence. It may therefore be broadly premised that the objects for which it is employed are two in number.

First. To exercise a chemical action upon the numerous constituents of the soil, and thereby produce a complete modification of its physical and chemical properties.

Second. To furnish it with the quality required by plants for their alimentation and growth. From the figures already given it will occur to the reflective mind that, regarded as a plant food, lime is of less direct importance from a commercial standpoint than either nitrogen, potash or phosphoric acid.

Placing the total quantity yearly removed by crops at an average of 50 pounds per acre a soil need only contain say, half of one per cent.

to supply all that could be demanded of it during several hundred years.

Its true agricultural value must consequently be attributed to its qualities as an *amendment* rather than a fertilizer.

The term "amendment" has been given to substances which, when they are applied to a soil, effect a change in its general constitution, and thus lime, when mixed into strong, stiff and unworkable clays in the proportion of from ten to fifteen tons to the acre, induces in them a far-reaching chemical decomposition, which, in addition to partially transforming them into the more porous silicates and aluminates of lime, sets free large quantities of alkaline salts that were previously unable to co-operate in the phenomena of vegetation because bound up in insoluble combinations.

This marvellous effect would of itself create for lime a very high place in the estimation of farmers; but it by no means represents the total scope of its usefulness, as will be clear to those who recall its properties as a generator and promotor of combustion. The accumulation of vegetable remains in various stages of decay and putrefaction, left in the ground by the crops or intentionally plowed under for the purpose, results in the production of a body known as humus. If left to itself this body would so acidify the soil as to destroy its normal basic or alkaline reaction. It could consequently no longer afford nourishment to any of those plants which generate the elements of animal food. In order to successfully cultivate such lands it is therefore necessary to neutralize their acidity; render them alkaline, and remove the excess of these organic matters.

All these conditions are perfectly fulfilled by burnt lime. The word "combustion" designates that process by which an organic body principally composed of carbon and hydrogen, with traces of nitrogen, unites with the oxygen of the air to form oxides. Thus, coal, coke, wood and vegetable refuse, although burnt to create heat, and apparently thereby destroyed, in reality merely undergo a chemical change, arising out of that scheme of nature which has provided for the restoration of all their constituents to the atmosphere and the soil.

The carbon continues with the oxygen of the air to form carbonic acid gas; the hydrogen and nitrogen, momentarily set free by this action, unite themselves together to form ammonia; while the ash consists of oxidized mineral matters.

With the exception of fluorine, every element combines with oxygen to form oxides, and in doing so develops more or less heat. The warmth of the animal body is created and sustained by the oxidation of the starchy or fatty or carbonaceous elements of food; and, hence, while animals breathe in oxygen, they breathe out carbonic acid, gas and steam. When this natural chemical process is stopped, the animal dies; or, to speak more forcibly, when no more food is provided, or no more oxygen

inhaled, the internal fire ceases to burn, and everything grows cold.

This is but a brief definition of combustion. It, however, suffices to establish that oxygen is the promoter of the phenomenon, and hence to explain that, if great masses of decaying humiferous matters sometimes linger in soils, it is because the latter are cold and wet and have become so choked up and cohesive as to preclude a proper circulation of air.

Oxygen is thus unable to reach them until they have been warmed, dried and made porous. Burnt lime, when properly administered, accomplishes all these objects.

By its great affinity for water and the intense heat of its combination, all moisture is absorbed. The rapidly drying soil cracks and opens up in every direction, and free ingress being thus afforded to the air, a vigorous and permanent combustion sets in.

Attacked in its turn by the carbonic acid gas resulting from the combustion process, it is converted into carbonate of lime, and, alkalinity being thus gradually restored, the plough completes the conquest, and barren wildernesses become fertile plains.

Reviewing these effects and briefly summing up its advantages, it will be seen that, independently of its power to impart porosity and to facilitate combustion, lime sets free various alkaline salts from useless combinations, and renders them available as plant-food. It also decomposes certain injurious salts of iron, magnesium and manganese, counteracts the evil influences of all kinds of sulphurous emanations, and, before being transformed into carbonate, destroys, by its causticity, vast quantities of ravaging insects and their eggs.

Despite these great advantages, it must be noted that the indiscriminate use of this powerful oxidizing agent on good ordinary cultivated soils would be productive of disaster.

Lest this statement be regarded as conflicting, it is explained that a good soil is what has been described as a mixture containing all the elements required for plant-food, in a proper physical condition, and with a due proportion of humus or organic matter. This humus is of the utmost importance.

First. Because, by its very slow oxidation or combustion it helps to maintain the warmth of the soil.

Second. Because it contains a considerable quantity of nitrogen, which is gradually transformed by this slow combustion into ammonia or nitric acid and nitrates.

Third. Because it has the invaluable property of always retaining moisture, and thus can enable plants to withstand periods of drought which would otherwise kill them.

However rich it may otherwise be, it has been demonstrated, by experiment, that no soil is perfect which contains less than two per cent. of humiferous matter.

This is why scientists untiringly urge upon farmers to provide for its maintenance by using

in addition to artificial fertilizers all the farm-yard manure they can scrape together and to carefully plough under, instead of burning, as they are so prone to do, all the refuse from their crops.

The imperative necessity of this duty is intimately connected with the most complicated problem yet remaining to be solved by agriculturalists, (i.e.) whence to obtain sufficient assimilable nitrogen to integrally replace what is taken from the soil by the crops, and exported with them to foreign countries every year, without having recourse to any of the costly commercial substances already enumerated.

The pet theory—so beautiful as a theory—of obtaining it directly from the air, in a suitable form, and at a fabulously cheap price, continues to occupy many clever brains in many scientific laboratories, but is still as far as ever from a practical solution; on the other hand since it has been proved that nitrification chiefly results from the extremely slow oxidation of organic matter in alkaline soils, it naturally follows that so long as there exists a sufficiency of humus under favourable conditions, no dearth of available nitrogenous plant food need be apprehended.

Unfortunately, the immense amount of exportation, combined with misconceived notions of sanitation, prohibit all hope of restoring to the lands the whole of the required nitrogen in an organic form. It is consequently all the more necessary to manipulate what remains in a spirit of economy; to handle the soil with delicacy, care and intelligence, and above all things, to avoid introducing into them any substance which may interfere with their normal, regular, and natural functions.

The White's Asbestos Company.

A meeting of White's Asbestos company was held in London on 1st inst., in opening which the chairman, Mr. W. M. Borradaile, said:—"Our company was registered on April 9, and our prospectus was issued on April 13. Before issuing the prospectus the board decided that they would not go to allotment unless 16,000 shares were applied for, as they considered that it was advisable that the working capital should be £10,000, and the cash payment to the vendors was £6,000. As a matter of fact, only 15,000 shares were applied for, but, on the vendors' agreement to take up a further 1,000 shares in the event of the directors calling upon them to do so, the board had no hesitation in going to allotment. The company having been formed, the engineer sailed for Quebec on April 25, arriving there on May 5. It took him about a fortnight to purchase his supplies and make the necessary preparations for commencing work, and on May 20 he arrived on the property. It will take a little time to develop this property to an extent which will yield large returns; but Mr. Boyd already reports a good show of asbestos on the face of his working, and we have every reason to be satisfied with the prospects which the work done so far holds out. In the last days of June Mr. Boyd made arrangements to commence work on a second property in Coleraine. In this mine, also, there is a good show of asbestos of good quality, and Mr. Boyd also reports a rich vein of soapstone ready for market. I am pleased to inform you, gentlemen, that the properties described in the prospectus have been duly conveyed to the company. Mr. Stuart, the Government Solicitor, having been our attorney in the matter. I may also mention that before coming home Mr. Boyd had selected several other properties, to the extent of about 500 acres, which will no

doubt be secured for the company at the Government price, which will probably not exceed £1 per acre. And now, gentlemen, I do not know that I have more to add; but as I have said, I shall be most happy to answer any question that may be asked. The asbestos mining, as regards Canada, is a comparatively new industry, having only become of importance within the last few years. It seems to be generally admitted that Canadian asbestos is superior in quality to that found anywhere else, and the demand for it is increasing rapidly, and is now in excess of the supply, as is evinced by the steady advance in price. Further developments will undoubtedly take place, but, so far as can be seen at present, good mines will continue to yield very handsome returns. These properties, gentlemen, were not selected in a haphazard way. Mr. Boyd has spent a considerable time over the matter, and made openings over 20,000 acres of ground before he bought the property."

The new Foxton Mining Company in Court.

Recently, in the Chancery Division of the High Court, before Mr. Justice Kay, Mr. Renshaw, Q.C. (with him Mr. Alexander) moved on behalf of the plaintiffs, Möller, Hunter and Lomer and the Foxton Phosphate Mining Company, Limited, for an injunction restraining the defendants, Maclean, Gay, Mew, Adams, Bingham and Langridge, from holding any meeting having for its object the removal of the plaintiffs from the directorate of the plaintiff company. The company was registered on April 18, with a memorandum of association, but no articles, so that Table A of the Companies Act applied. On the same, April 18, in accordance with Section 52 of the Act, the subscribers to the memorandum appointed the three plaintiffs to be directors. All the defendants, except Gay, were subscribers to the memorandum; Maclean and Mew were clerks in the office of the solicitors of the company, Adams was the secretary, and Bingham and Langridge were clerks in his office. The only suggestion made in the affidavits filed on the part of the defendants as to why the plaintiffs were not properly appointed was that the appointment was made before the actual registration of the memorandum and articles. The plaintiffs had allotted shares and notices had been sent out, but since the defendants had taken upon themselves to act as directors the allotments had been cancelled.

Mr. Justice Kay: Until the memorandum was registered there was no incorporation. There can be no directors before the company exists.

Mr. Renshaw said that after the incorporation the election of directors was confirmed.

Mr. Justice Kay said that until the company was incorporated the subscribers to the memorandum were merely promoters, and could not appoint directors.

Mr. Renshaw pointed out that Table A provided that the names of the first directors should be determined by the subscribers to the memorandum.

Mr. Justice Kay repeated that until they became a corporation they had no power to appoint directors. If the names of the directors were put in the articles, it was just as though every subscriber had put his hand and seal to the deed appointing those persons directors.

Mr. Renshaw observed that here every subscriber had concurred in appointing the directors. According to the minutes, it appeared that after the incorporation of the company the

subscribers to the memorandum met and appointed the plaintiffs as directors, and this was a good appointment.

Mr. Justice Kay suggested that a meeting of the company should be held and directors appointed.

Mr. Renshaw said there was a difficulty about this, as it was not known to what extent particular individuals were or were not shareholders, as the defendants had cancelled the allotments. On June 5, at a meeting of the subscribers, additional directors were appointed, and the election of those before nominated was confirmed.

Mr. Martin, Q.C. (with him Mr. Farwell), for the defendants, contended that the plaintiffs had not been validly appointed, as the notice did not state the object of the meeting; next, that a majority of the subscribers was not present, and proper notice of the meeting was not given. He was quite ready to call another meeting of the subscribers if what had been already done was not sufficient.

Mr. Justice Kay said he had seldom seen such a series of blunders committed in connection with any joint-stock company. The notice of motion asked that the defendants might be restrained from holding any meeting having for its object the removal of the plaintiffs (other than the company) from the directorate, and from in any way interfering with the plaintiffs in their position as directors, and from appointing any other directors until the trial of the action. It was the first time he had ever heard such an application brought before the court. It was said that the plaintiffs were appointed directors by the subscriber to the memorandum before the company was registered; but this could not be so, as table A had no relation to a joint-stock company until it was registered. The plaintiffs were never appointed directors alone by any proceeding after the company was registered. According to the first minute, the plaintiffs and a Mr. Curzon were appointed directors, but the date of this appointment was uncertain, as there appeared to have been an alteration made in the book, though no one could say by whom it was made. On June 4, a notice was issued by the secretary to the effect that in consequence of the irregularity in appointing directors, a meeting for that purpose would be held on the following day, and from the minutes it appeared that six of the subscribers attended, when it was proposed that the plaintiffs should be appointed. To this an amendment was made, adding two other names, and the amendment was carried. The plaintiffs in their affidavit stated that the subscribers met on June 5, and "effected to appoint additional directors, although we have refused to recognise any such appointment." So that the plaintiffs maintained that the only valid appointment of directors was before the company was registered. It was not necessary to go further, but he might observe that on April 23 the plaintiffs purported to allot shares, though, upon looking at the minutes, he found they had not been signed, as they ought to have been. Then, on July 5, the first meeting of shareholders was called; but to this no one but the subscribers were summoned. The proposition on which the motion was based—viz., that the plaintiffs were the only directors of the company—depended upon their having been appointed before the company was registered, and he was of opinion that this was an invalid appointment. Therefore, the people who were really the directors were all the subscribers to the memorandum. Whether anything had been done since binding upon any human being he did not now decide. The motion would be refused with costs.

Sinking Appliances at Llanbradach.

An Interesting Paper Descriptive of a Plant in which the Author has Applied Successfully a Number of Original and Useful Ideas.

BY W. GALLOWAY.

(From Proceedings of the South Wales Institute of Engineers.)

(Continued from July issue.)

The water from the bottom of the shaft has hitherto been raised by means of an arrangement imagined and carried out by the author in January last. He had long regarded the laborious and expensive method of bailing the water by hand into a barrel with open top (occupying the whole attention of three, four, or more men, when the quantity to be removed amounted to between 2,000 and 3,000 gallons an hour, and limited in its application to that amount) as a reproach to the art of mining. Having considered various methods of effecting the same object by mechanical means, he at length decided to fill the water-barrel by means of a vacuum, making it air-tight at the top, and providing it with a valve opening inwards at the bottom.



Fig. 10. Pneumatic Water-Barrel. Scale, $\frac{3}{4}$ in. = 1 ft.

Figs. 8, 9, 10, 11 and 12 represent this arrangement, and its principal details, as applied at Llanbradach. The *pneumatic water-barrel* consists of a cylindrical vessel of sheet-iron, 4 feet 2 inches in diameter, and 8 feet high, closed at the top, in which there is a door, *a*, bolted to the cover, and serving as a means of access to the interior when removed. The bottom, *c, d*, is 5 inches above the bottom of the cylinder. It consists of a steel plate $\frac{5}{8}$ inches, with a central opening 18 inches in diameter. The valve-seat was turned in a lathe, so as to secure perfect trueness. The valve, *b*, consists of a block of cast-iron, *e* (Fig. 12), having its lower face and vertical sides turned quite true. Over this turned face a sheet of leather is tightly *cupped*, and held in place by a tightly fitting wrought-iron hoop, *f* (Fig. 12). The hoop is secured by three tapping bolts, *g* (Fig. 11). A circular plate of iron, 16 inches in diameter, is bolted to the bottom of the valve, as shown, by means of six bolts with counter sunk heads. A spindle *h* (Fig. 9), working through two guides, and having a turned ball at its lower end, is held loosely in a socket in the valve, as shown in Figs. 9 and 12. In this manner the vertical movement of the valve is secured, while the ball and socket joint enable it to accommodate itself to the seat in any position into which it may be turned. At *k* (Figs. 8 and 9), one-half of an instantaneous coupling, identical with those used by the



Fig. 11. Pneumatic Water-Barrel. Scale, 1 in. = 1 ft.

Vacuum Brake Co., and supplied by the same makers, constitutes the outside termination of the pipe *l*, which, passing through the side of the cylinder, rises to within an inch of the top

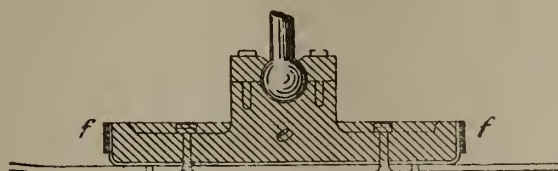


Fig. 12. Pneumatic Water-Barrel. Scale, 1 in. = 1 ft.

in its interior. A glass gauge at *m* shows the height of the water in the interior when it rises to that elevation. The instantaneous coupling and the water-gauge are both protected by a strong angle-iron rib, *n* (Figs. 8 and 9), which projects from the side of the cylinder, as shown, and serves to guard them from the blow given by any large body such as a bucket. Care must be taken not to allow the point of a leg of a

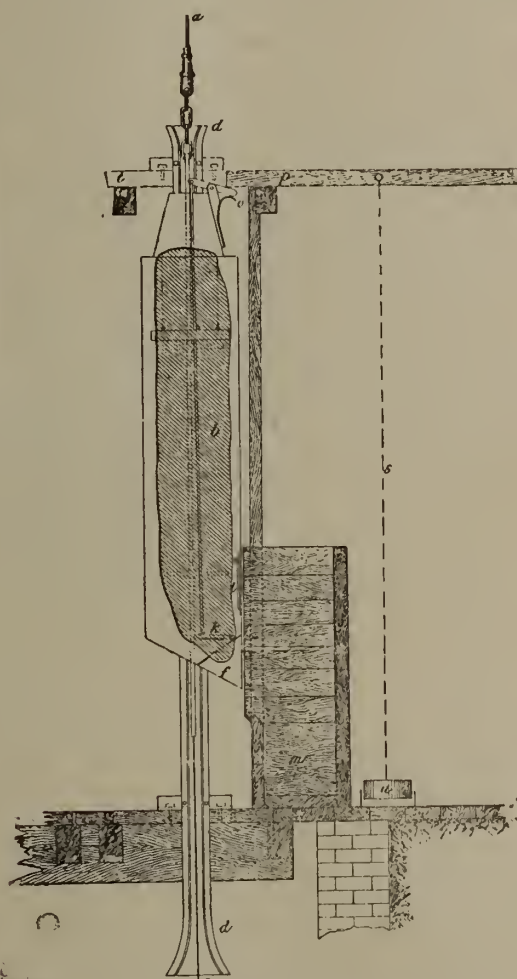


Fig. 13. Automatic Water-Tank. One side partly removed. Scale, $\frac{1}{4}$ in. = 1 ft.

drilling-machine, which is being let down by the winding rope, to enter between the angle-irons. The author has known of one gauge-glass being broken in this manner, and giving rise to a loss of time amounting to half an hour, while it was being replaced, but he does not know of any other instance of such an accident. This one could have been quite easily avoided by the exercise of the slightest degree of foresight on the part of the man in charge of the shift.

The vacuum is created by means of an ordinary air-pump condenser constantly working at the surface. The steam-cylinder of this air-pump is 10 inches in diameter by 20 inches stroke, and steam is cut off at one-fifth of the stroke by means of adjustable hand-gear. The

vacuum pump is 14 inches in diameter by 20 inches stroke, coupled tandem-fashion to the piston-rod of the steam cylinder. This engine produces a vacuum equivalent to a column of mercury from 20 to 22 inches high, both in a receiver near the top of the shaft, consisting of an old egg-end boiler 24 feet 8 inches long by 5 feet in diameter, and in a system of pipes of 3 inches in diameter, communicating with it, one of which descends to the bottom of the shaft. It is there connected with a flexible hose 30 feet long by 2½ inches in diameter, provided with a stop-cock, and terminated in one-half of an instantaneous coupling corresponding to the other half, which is affixed to the pipe *l* of the water-cylinder, in the manner already described.

When it is desired to fill the pneumatic water-barrel, it is lowered to the bottom of the shaft, and rests with its hollow end under water. One man then attaches the instantaneous coupling of the flexible hose at *k*, opens the stop-cock, and observes with a light at *m*, when the water rises in the gauge-glass. As soon as he notices the water rising to the desired height, he shuts the stop-cock, detaches the instantaneous coupling, and apprises the man in charge of the signal that all is in readiness. The latter then signals to the winding engine-man, who thereupon raises the water-barrel with its contents to the surface. On its arrival there the banks-

man shuts the doors, draws a water-trolley under it, and signals to the engine-man to lower it. When this is done, the barrel descends; its valve is arrested on the top of a conical block of wood; and, as it descends further, the water pours out into the water-trolley, and flows thence into a wooden trough, which conveys it into a drain provided for the purpose. In this manner the water-barrel is filled in 30 seconds and emptied in 30 seconds, while the remaining manoeuvres occupy about 1½ to 2 minutes. It has been possible, with this arrangement, to sink in the Pennant sandstone, with 5,000 gallons an hour in the

bottom of the shaft, at the rate of 5 and 5½ yards a week; the highest rate of progress in the same ground with only 500 gallons an hour, having been 6½ yards a week. At one time, when the quantity of water in the bottom rose to 7,000 or 7,500 gallons an hour, the rate of progress attained was rather under 4 yards a week, the rock being at the same time exceed-

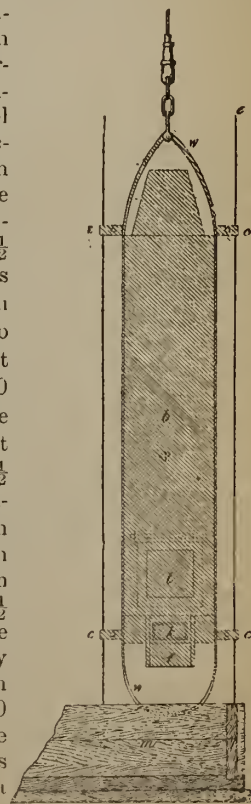


Fig. 14. Scale, $\frac{1}{4}$ in. = 1 ft.

ingly hard and compact. Although these quantities of water are, comparatively speaking, insignificant when pumps can be applied to elevate them, they are sufficient to render sinking impossible by the system of bailing. The establishment of pumps in this shaft was a question that could not very well be solved at the commencement of the operations, as it was impossible to determine what quantities of water were likely to be met with; and even as the sinking progressed from day to day, the uncertainty continued the same, so long as the bottom of the Pennant sandstone had not been reached, and the Shale series entered upon. All the Collieries surrounding Llanbradach except Albion—namely, Harris's Navigation, Newport Abercarn, Abercarn, Risca, and Caerphilly Collieries—are provided with heavy pumping machinery and powerful engines, all of the Cornish type except the one at Caerphilly Colliery, which is one of Barclay's patent engines. At Albion Colliery, on the other hand, there are two or more direct-acting steam-pumps established in lodgments made in the side of the shaft.

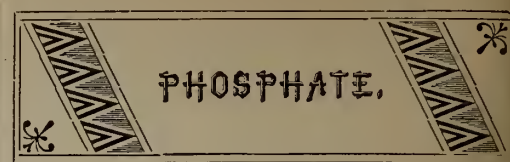
The shaft at Llanbradach is situate about equidistant from Albion, Caerphilly, Risca, and the two Abercarn Collieries. Under these circumstances, the author did not feel justified in advising the owners to establish either light or heavy pumping machinery. If he had advised heavy pumping machinery at the commencement, the cost would have been very great; and if he had advised light pumping machinery, there was a possibility that his advice might have been stultified by the result, and that the light machinery would require to have been removed, and to have been replaced by more expensive appliances. The specification under which the shaft is being sunk defines 4,000 gallons an hour in the bottom, as the maximum quantity with which the contractor has to deal; and that when the quantity exceeds this amount, whether pumps have been provided or not, he is to receive certain allowances, which are left to the discretion of the engineer. The allowances for extra water to a depth of 193 yards have amounted to £498, or an average of about £2 12s. per yard over the contract price. But the aggregate quantity of water met with down to a depth of 135 yards from the surface amounted to 9,000 gallons an hour—namely, 5,500 gallons above 95 yards, and 3,500 gallons between 95 and 135 yards. Of these two quantities, 5,000 gallons an hour were walled out by means of brick and cement walling, leaving only 500 gallons an hour in the bottom at 95 yards. Below 95 yards the water gradually increased up to 3,500 gallons an hour at 135 yards. At the last-named point a piece of an old boiler, 5 feet in diameter and 10 feet 6 inches long, with one end open and the other closed, was fixed on a beam, with its centre directly below the rope of the small winding-engine, and that engine was employed in raising the whole of the water running into the shaft, except some 500 gallons an hour which escaped from the sides between the bottom and the collecting curb.

As the shaft was deepened still further, the quantity of water issuing from the rock below the collecting curb gradually increased, until at length it amounted to 5,000 gallons an hour between 135 and 190 yards. But in the meantime the springs between 135 and 95 yards had decreased to about 1,800 gallons an hour. The cistern was then lengthened to 14 feet 6 inches, and fixed at a depth of 190 yards, a collecting curb having been put in, as in the former case, and the 1,800 gallons an hour collected at the

higher curb was also run down into it in 3-inch pipes. Another stronger engine was then put to work to raise the water from this cistern, and easily raises 5,000 gallons an hour by means of the following apparatus, of which the principal details are represented in Figs. 13 and 14:—*a* is the winding-rope of the auxiliary winding-engine, and *ee* (Figs. 13 and 14) the guide-ropes; the two latter ropes are fixed in the bottom of the cistern at 190 yards, pass over two pulleys, *f* (Fig. 1), above the winding-pulley, and are wound upon two small hand-crabs standing on the surface at some distance from the shaft, on which there is sufficient rope to reach to a depth of 500 yards if required. The tank, *b*, is 2 feet square inside; has parallel sides for 8 feet of its length; terminates upwards in a pyramidal frustum-shaped top, which is bolted to its square part and can be removed when desired; and has a bottom sloping from front and back towards the centre, as shown. Four projecting studs, *cc*, one on each side, at top and bottom, clasp the guide-ropes loosely. The tank is guided by these ropes in ascending and descending the shaft, but when it reaches the top the studs on each side pass between fixed guides, *dd*, each consisting of two bars of angle iron riveted to a long plate of sheet-iron and made fast to the woodwork.

A valve, *k*, in the bottom serves both as a means of filling and as an outlet for the water which escapes into a sloping adjutage, *f*, and precipitates itself thence into a wooden trough, *m*, whence it runs into the drain mentioned in connection with the *pneumatic water-barrel*. The valve *k* is raised by means of the lever *o*, which comes in contact with a movable wooden bar, *p*, working between two iron guiding-bars, not shown in the drawing. A weight, *u*, suspended from the bar *p* by means of a chain, *s*, can be regulated so as to open the valve. The bar *p* turns upon an iron bolt at *g*, which serves as a hinge to the system. The upper ends of the fixed iron guides are attached to two wooden beams, *t*, one vertically above each side of the opening through which the tank reaches the surface, and their lower ends are secured at *v* in a similar manner to the sides of the opening just named. The suspending bow, *w*, of the tank passes down each side and under the bottom, as shown, the latter part being curved in the form of a semicircle, and serving as a protection to the bottom of the tank when it is lowered to the bottom of the collecting cistern, where it comes to rest on a sheet of india-rubber $\frac{1}{4}$ inch thick. The filling and emptying of the tank are purely automatic, and only one man is required to attend the engine. This tank can be easily filled and emptied twenty-four times an hour from a depth of 190 yards; and as its capacity is about 212 gallons, it brings, as previously stated, about 5,000 gallons of water to the surface during every hour it is at work.

The author may state, in concluding, that he has had the intention from the first, provided circumstances were favorable, to recommend the owners to apply a direct-acting steam-pump to raise the water met with in sinking so soon as a point was reached at which most of it could be collected. He has now advised them to put in a compound Worthington pump capable of dealing with 10,000 to 12,000 gallons an hour, at the nearest point below 200 yards at which a lodgment can be conveniently formed, and preparations are being made to carry out his suggestions. He hopes also that at an early date he may have the honor of presenting some further details of the same subject to the members of the Institute.



In General.

Following up our comment upon the commercial future of our immense area of phosphate lands and the existing demands for such from outside sources, the *Trade Review*, in a recent issue, makes the following pointed and well-timed reference:—"The speculator has, it must be admitted, too hard a grip upon our phosphate land, while the 'promoters' upon the other side of the Atlantic only care for the money they can make by floating a company, since it matters not to them whether the enterprise is a paying one or is a miserable failure. If we once get a bad name in this respect, then woe be to us! Moreover, over-capitalization is a stumbling block which is ever in the way of joint stock enterprises. It takes no argument to show that the smaller the amount of capital embarked, consistent with effective and enterprising work, the more certain the chances are of paying a respectable and satisfactory dividend, while the better pleased will the stockholders be, and the better disposed to take an interest in other Canadian undertakings. If we are careful with respect to the properties we place upon the market and the amount at which we capitalize them, there can be no question as to the long life and prosperity of the already important Canadian phosphate interest."

Two very important phosphate suits have just been terminated in South Carolina after going through the highest courts for ten years. The State discovered in 1887 that certain parties were working phosphate properties belonging to the commonwealth, but which were claimed by those in possession and who declined to negotiate for a release of the same. Their aggressive attitude was continued throughout the progress of the cases in court, and a large array of legal talent was employed on both sides to fight the issue. The contest was one of the most exciting and interesting ever known in the State, and the outcome has an important bearing on other phosphate interests, as the successful litigation will no doubt encourage similar attempts to seize disputed mining property in the State from which no royalty is received on leases. The State won both cases, and the net result may be summed up as follows:—

First, the acquirement by the State of the title to the Morgan Island marshes, embracing over 5,000 acres of phosphate marsh lands. Second, the establishment of the title of the State to the Chisolm's Island creeks, containing also a valuable phosphate deposit. Third, the payment into the State treasury, as a net balance after defraying the expenses of all these cases, of nearly \$32,000, being a reduction of \$44,000 from the original verdict of the court, on account of the assignment of the company against whom the judgment was obtained for damages.

This has put a quietus on phosphate land speculation which started out with great enthusiasm about three months ago, as prospective buyers are satisfied to wait until the State has finished the investigation of other claims. The result of the suit is, of course, gratifying to mining companies who are working property leased from the State, as it removes formidable competition and may maintain market values for phosphate rock.

The attention of our readers is directed to the following extract from a letter received from Messrs. Danbmann Bros. & Co., Chemical and Super-Phosphate Manufacturers, Baltimore:—

"As holders of the Canadian Patent No. 31,114, we are in possession of an improved process for converting to soluble form the Phosphoric acid of Phosphatic rocks, which has special advantages applied to Apatite, and being desirous of entering into communication and forming a connection with such parties in Canada as would find an interest in this process, we are led to lay the matter before you, hoping for your good assistance toward that end.

We ask your attention to the following fact: Our process enables us (as experimentally proved) to produce from Canadian apatite a Phosphate containing about 40 per cent. "available" Phosphoric acid, of which nearly all is "soluble." In view of the controlling importance of freight charges in the distribution of Fertilizer material, it is easy to see the value of a process that minimizes these changes, by giving a concentrated product apart from the increased intrinsic value of that product for manurial purposes. Manufactured near the mines such a phosphate ought to reach the consumer with less than one half the usual freight on ordinary goods for a shipment of equal value.

Again our process obviates one great objection to the use of Canadian apatite, which has stood much in its way with manufacturers in the United States, viz: the disengagement of Hydro-fluoric acid and Chlorine by the ordinary treatment with Sulphuric acid. In manufacture by our process the fluorides and chlorides are not perceptibly attacked and remain inert. The two points to which we have asked your attention, are the main advantages of our new process, which, as you will at once perceive are of especial value to Canadian Manufacturers and Miners.

Ocean Shipments.

The following are the ocean shipments from Montreal to Europe, to date:—

Date.	Vessel.	Destination.	Shipper.	Tons.
July 5.	S.S. Fremona	London	Lomer, Rohr & Co	600
" 8.	" Vesta	Liverpool	"	160
" 12.	" Erl King	London	Millar & Co.	235
" 16.	" Lauderdale	W. Hartlepl.	Lomer, Rohr & Co	200
" 16.	" Canadian	London	Wilson & Green.	444
" 18.	" Circe	Glasgow	"	212
" 19.	" Fort William	Bt'g Glasgow	Lomer, Rohr & Co	225
" 23.	" Bark. Parejero	Glasgow	Wilson & Green.	150
" 23.	" S.S. British Queen	Liverpool	Lomer, Rohr & Co	305
" 23.	" Canopus	"	"	190
" 23.	" "	"	Millar & Co.	185
" 26.	" Michigan	London	Lomer, Rohr & Co	220
" 29.	" Lake Huron	Liverpool	"	375
" 30.	" Hilaria	London	"	440
" 31.	" Montreal	Liverpool	"	375
Aug. 3.	" Bonnington	London	"	300
" 2.	" Grecian	"	Millar & Co.	300
" 2.	" "	"	Lomer, Rohr & Co	180
" 2.	" "	"	Wilson & Green.	387
" 6.	" Kehrweider	Hamburg	"	256
" 6.	" Merch't Prince	London	Lomer, Rohr & Co	300
" 6.	" Vancouver	Liverpool	Millar & Co.	130
" 9.	" Earl of Zetland	"	Lomer, Rohr & Co	350
" 10.	" Bark Skjald	W Hartlepool	"	100
" 14.	" S.S. Steinhoff	Hamburg	"	240
" 15.	" Gordon Castle	London	Lomer, Rohr & Co	385
" 15.	" "Acuba"	"	"	110
" 15.	" Bark "Elsiva"	"	"	100
" 17.	" S.S. Assyrian	"	Wilson & Green.	258
" 19.	" Circe	Glasgow	"	185
Total.....				7897

RECAPITULATION.

London.....	4259	Tons.
Liverpool.....	2070	"
Hamburg.....	496	"
Glasgow.....	772	"
West Hartlepool.....	300	"
Total.....	7897	
Lomer, Rohr & Co.....	5155	Tons.
Wilson & Green.....	1802	"
Millar & Co.....	850	"
Total.....	7897	

English Fertilizer Market.

We are indebted to Messrs. Couper, Millar & Co., London, for the following report of the English fertilizer market, dated 16th instant:—

We have to report a continuance of the firmness of prices of all raw materials and a somewhat larger volume of business than is usual at this time of year.

Mineral phosphates.—Although shipments of Canadian have been coming forward with fair regularity, there still remains a large quantity

to be shipped, and the rise in price is counterbalanced by the increased rates of freight; 80 per cent. is quoted at 12½d. to 12¾d., according to port, and 70 per cent. finds a ready market at 10½d., both with ½th rise. South Carolina is quoted 10½d., but even at this figure, the raisers do better by selling it to U.S.A., where the increase in the consumption of super-phosphates is still going on. Very few fresh sales are reported in the high grades of Somme phosphate, and prices show signs of rising still further when the autumn season sets in. There is a good demand for 50, 55 and 60 per cent qualities. Belgian 40 to 45, and 45 to 50 per cent. we can offer at the usual prices, both for this year and next.

Templeton District.

We are glad to see that all the talk about a line of railway into the Templeton district is at last beginning to assume some definite form, for the last issue of the *Official Gazette* contains a notice of application for incorporation by the Templeton Phosphate Railway Company. The proposed line is to have its starting point from the Ottawa River, near East Templeton, and will run as far as the Gore of the Township, or a distance of some sixteen miles. It is also proposed to build another line starting at the 8th or 10th Range of Templeton, near Perkins' mills, running in a westerly direction about 15 miles. The offices are to be in Montreal. The capital stock is placed at \$50,000. The names of the applicants, all of whom are to be first directors of the road, are the Honorable Alexander W. Ogilvie, senator; Raymond Prefontaine, M.P., advocate; Azro B. Chaffee, gentleman; George G. Foster, advocate and Arthur Gagnon, gentleman, all of the city of Montreal; Hugh McMillan, M.P., Rigaud; Louis N. Champagne, advocate, Hull; Alphonse Lemieux, Quebec; and Robert Hargrave Martin, New York. There can be little doubt that the construction of such a railway as this is highly desirable, and that numerous benefits to the phosphate interests would ultimately result from it. Whether the promoters really mean business is a question which time only will tell.

Mr. Robert Blackburn is equipping his mine with heavier machinery than that formerly in use. Work goes along briskly, as usual, and a good output of phosphate is being produced.

Lievre River.

Mr. O. M. Harris, Montreal, representing the Canadian Phosphate Company (Limited), under date of 24th of August, writes:—"You will be pleased to learn that both our Crown Hill and Star Hill mines are at present looking very favorable, and last week's output averaged about 195 tons, which is very satisfactory. Pits Nos. 2, 3 and 9 at Star Hill, and 6 and 8 at Crown Hill, are looking splendid for future working, there being a large quantity of rich phosphate in sight there. Our improvements at Crown Hill are almost all completed, and when they are, both our Crown Hill and Star Hill will undoubtedly equal the best equipped mines in this country. We have everything ready to handle a large output, with the exception of a tram-road from our Star Hill mines to Landing, but hope the time will soon come when the output from this mine will permit of our going to this expense."

We regret to have to record a couple of accidents—one of them unfortunately resulting fatally—at these mines. While a car loaded with rock was being hauled up the tramway, on 17th inst., a lad named Gleeson, employed as a

driver, fell in front of the wheels, which passed over him and caused instantaneous death. No blame is attributable to anyone, as the accident was entirely due to the lad's thoughtlessness. In the other casualty, Mr. Tom Lyons, mine foreman, sustained a severe shaking up and several bruises by a fall of some 25 feet while in No. 5 pit. We are pleased to learn that Lyons will soon be about again.

The output of phosphate from the High Rock pits is again up to the old standard. The vein, which had pinched out somewhat in No. 11, has come to the fore again, and is yielding as abundantly as ever. The management have been, however, again unfortunate enough to lose another loaded scow, which upset a few days ago in the Rapids.

Kingston District.

"It has been observed that the 'note' of quickened interest in phosphate mining near Kingston does not take the direction of intelligent efforts for the improvement of roads and the erection of a grinding mill. Men who are bent on mere speculation obtain the "chance" or "option" of buying property in order to sell out. If they can find a buyer the owner of the land gets his money, and if not the farmer is left with a registered document affecting the title to his land and a job for a conveyancer when the boom is over. No permanent good to the country is likely to come from this kind of speculation. No wonder that money and men seek other countries, where intelligence and activity go hand in hand to reduce the friction of tedious transportation and expedite business."

Edison Prospecting for Iron Ore.

A report from Reading, Pa., states that Thos. A. Edison, Samuel Insull and Mr. Kennally, of the London Electric Light Company, after eight days hard work, completed on the 17th inst. the survey of vast magnetic iron ore leases in this country and returned home, after seeing their new plant for separating ore by electricity in operation. During the survey their work frequently extended until 2 o'clock in the morning. Each carried a cylindrical brass box fitted with a magnetic needle. The dipping of the needle indicated the depth of the ore and thickness of the vein. The new magnetic ore separator is located on Gilbert's Hill, on a ten-acre tract near Bechtelsville. Iron stone is found here in large quantities. The stone and ore that hitherto was handled at heavy cost is now utilized at greatly reduced figures. The plant just erected to experiment with, cost \$35,000. It is 120 feet long, 31 feet wide, and is divided into three sections. Immense engines, ore crushers and dynamos do the work. The iron ore is crushed into fine sand. It is then carried along on belts and up into the third story, where it drops into a hopper. The crushed ore is then shaken out and dropped some eight feet, where it comes in contact with a powerful magnet, which draws all the iron ore to one side, swerving its falling course into a trough leading to a large bin, while the particles of matter containing no ore descend perpendicular and drop into a refuse bin. The magnet draws the crushed particles of iron completely out of the sand and dirt as it falls from its height, and it is very interesting to watch the stream of iron being swerved from its course by the magnet. The refuse sand is run past the magnet a second time to secure all the iron that remains in it. Where the "separator" is located, the dust is so fine and profuse that every person who goes into that portion of the building, which is 20 by 30 feet

and three stories in height, wears a patent rubber mask over his mouth and nose and breathes through a wet sponge. Rock ore is being taken out which yields fifty per cent. of ore. This invention can only be applied to magnetic ore. At the present time 150 tons of rock are on an average mined and separated per day of fifteen hours. One ton of prepared ore ready for the furnace is obtained from seven to nine tons of rock. It is said that ore prepared by this separator requires about one-third less fuel than the ordinary ore to smelt. No. 1 pig metal is the result of the smelting of this magnetic separated ore. The refuse sand is said to be worth about \$1 a ton, and the intention is to use it in the manufacture of an artificial stone for monuments, paving blocks, etc.

Gold Mining Supplies.

The principal depot in Nova Scotia, carrying the most complete assortment of first class goods, is

H. H. FULLER & CO'S,
41 to 45 Upper Water St., Halifax, N.S.

Our line comprises Explosives, Fuse, American and English Mill and Hammer Steel, Bar and Bolt Iron, Steel Wire Hoisting Rope, Hemp and Manilla Rope, Rubber and Leather Belting, Miners' Candles, Oils and Lamps, Miners' Tools, Machinists' Tools, Blacksmiths' Tools, and every requisite for the gold miner.

H. H. FULLER & CO.,
Halifax, N.S.

MINING NOTES.

We shall be greatly obliged to mine owners and superintendents for such authentic reports of their operations as may concern shareholders and the public.

At the Annual Meeting of the Gold Miners' Association of Nova Scotia, held at Halifax, on 6th March, a resolution was passed adopting the "Canadian Mining Review" as the official organ of this Association. Our readers may therefore rely upon the accuracy of all information published in these columns bearing on the gold mining industry of the Province.

Nova Scotia.

Pictou and other Districts.

At the Albion, the bottom of the Foord shaft has been reached, and on the exploration of the mine, everything looked favourable.

The Drummond colliery—owned by the Inter-colonial Coal Company—is being worked night and day, and shipments steadily maintained.

We regret that, by some unforeseen circumstance, our usual interesting budget of items from the gold mines should not have reached us in time for publication in this issue.

The Acadia colliery has been idle for three weeks, owing to a break down of the hoisting engine, but so soon as the necessary repairs are completed, a night shift will be started in addition to the day shift. The engines will for a time be run at a reduced speed, until the bearings be worn down to place. This is done for the purpose of getting out and maintaining the usual output.

Nova Scotia Gold Yield for Half Year Ended 30th June.

We are indebted to the extreme courtesy of that admirable institution at Halifax, the Department of Works and Mines, for the following full and complete statement of the gold yield for half year ended 30th June last, from the various districts at present in active operation throughout the Province:—

Sherbrooke District.

1889.	Rock Crushed. Tons.	Cwts.	Oz.	Gold Yield. Dwts. Grs.
January...	276	..	45	8 12
March....	280	..	46	9 ..
April.....	36	..	5	8 ..
May.....	200	..	29	1 ..
June.....	221	..	32	9 ..

Salmon River.

January...	210	..	66	.. ..
February..	620	..	235	.. ..
March....	674	..	159	.. ..
April.....	520	..	198	.. ..
May.....	650	..	252	.. ..
June.....	550	..	160	10 ..

Lake Catcha.

January...	138	..	89	1 ..
February..	99	..	44	.. ..
March....	96	..	32	2 ..
May.....	35	..	68	12 ..
June.....	27	..	31	12 ..

Whiteburn.

January...	98	..	125	16 10
February..	53	..	105	10 3
March....	72	..	157	3 19
April.....	135	..	255	6 5
May.....	161	..	252	9 14
June.....	147	..	193	14 15

Caribou.

January...	826	..	278	9 16
February..	418	..	142	13 7
March....	590	..	219	17 15
April.....	540	6	143	10 18
May.....	583	..	109	12 ..
June.....	536	..	93	6 ..

Uniacke District.

January...	148	..	99	5 ..
February..	273	..	99	5 20
March....	154	..	122	9 15
April.....	30	..	121	8 ..
May.....	76	..	5	17 ..
June.....	116	..	177	18 15

Malaga.

January...	475	..	387	17 ..
February..	395	..	171	5 ..
March....	344	..	302	17 ..
April.....	167	..	118	.. ..
May.....	140	..	46	10 ..
June.....	157	..	59	3 ..

Ecum Secum.

March....	100	..	103	15 ..
April.....	188	..	33	5 ..
May.....	45	..	38	4 ..
June.....	50	..	80	10 ..

Central Rawdon.

January...	60	..	139	.. ..
February..	90	..	179	.. ..
March....	100	..	211	.. ..
April.....	120	..	255	.. ..
May.....	120	..	350	.. ..
June.....	100	..	394	.. ..

Montague.

January...	25	..	30	10 ..
February..	52	..	71	8 ..
March....	46	..	66	10 ..
April.....	70	..	168	5 ..
May.....	81	..	155	9 ..
June.....	82	..	87	14 ..
".....	..	..	4	.. ..
			91	14

Kempt.

1889.	Rock Crushed. Tons.	Cwts.	Oz.	Gold Yield. Dwts. Grs.
January...	5	..	3	.. ..
February..	24	..	21	.. ..
March....	37	..	37	.. ..
April.....	15	..	13	10 ..
May.....	30	..	28	10 ..
June.....	30	..	16	10 ..

Renfrew.

March....	85	..	77	16 ..
April.....	251	..	101	11 14
May.....	58	..	160	5 ..
June.....	204	..	139	15 1

Leipsigat.

February..	4	..	12	.. ..
March....	10	..	4	.. ..
April.....	3	..	10	1 4
June.....	15	..	15	17 13

Wine Harbor.

February..	90	..	49	9 ..
March....	92	12	59	7 ..
April.....	40	16	7	15 ..
May.....	3	..	3	.. ..

Oldham.

January...	175	..	149	2 18
February..	149	..	134	18 6
March....	139	..	298	8 ..
April.....	144	2	304	14 12
May.....	132	..	503	7 10
June.....	104	..	35	8 ..

Moose Head.

April.....	97	..	37	15 ..
May.....	17	..	4	4 ..
June & July	65	..	17	9 ..

Lochaber.

January...	25	..	19	17 ..
February..	45	..	29	4 ..
March....	17	..	10	4 ..

Chezetcook.

Reported to 30th June	80	..	7	9 ..
-----------------------	----	----	---	------

Killag.

March....	5	..	10	11 10
-----------	---	----	----	-------

Gold River.

Reported to 30th June	384	..	112	2 ..
-----------------------	-----	----	-----	------

Tangier.

March....	35	..	12	10 ..
April.....	14	..	3	2 ..
May.....	35	..	14	3 ..
June.....	20	..	15	7 12

Brookfield.

January...	105	..	184	.. 16
February..	109	..	215	11 2
March....	220	..	303	.. ..
April.....	176	..	251	.. ..
May.....	111	..	139	.. ..
June.....	99	..	125	.. ..

Fifteen Mile Stream.

March....	96	..	47	.. ..
April.....	110	..	43	15 ..
May.....	108	..	50	10 ..
June.....	160	..	88	.. ..

Stormont.

January...	491	..	283	.. ..
March....	274	..	170	10 ..
April.....	247	..	175	10 ..
May.....	280	..	148	5 ..
June.....	238	..	188	2 ..

At the Black Diamond colliery work is progressing slowly.

We notice that incorporation has been sought for by the "East River Gold Mining Company, Limited." The capital is placed at \$2,700 in \$100 shares. The names of the applicants are: William A. Malling, 110 Barrington street, Halifax; Charles W. Outhit, 112 Barrington street, Halifax; Jacob Withrow, 104 Barrington street, Halifax; Silas Hubley, 12 Bedford Row, Halifax; A. C. Layton, 37 Argyle street, Halifax; John F. Outhit, 112 Barrington street, Halifax; W. H. Teas, 151 Hollis street, Halifax; Thomas Hanson, Windsor; Cyrus Hubley, 11 John street, Halifax; Geo. L. Flawn, Granville street, Halifax; Thomas A. Hubley, 35 John street Halifax; Benjamin J. Hubley, 35 John street, Halifax; Edwin Hubley, 12 Bedford Row, Halifax; George B. Maling, 191 Brunswick street Halifax, and George Maling, Windsor street, Halifax.

The contracts for the supply of coal for the Intercolonial railway for the year ending 30th June, 1890, are reported to have been as follows: Cumberland Railway and Coal Co., Spring Hill, 92,000 tons; Phoenix Coal Co., Maccan, 23,000 tons; Cumberland Coal Mining Co., Maccan, 10,000 tons; Acadia Coal Co., from Yale and Albion Collieries, 30,000 tons; Intercolonial Coal Mining Co., Westville, 20,000 tons; Black Diamond Coal Co., Westville, 10,000 tons. The prices are said to range from \$1.90 to \$2.20 per ton.

The New Glasgow Coal and Iron Company has sunk a prospecting shaft on their property at Springville, and at a depth of 45 feet drifting is being carried on. Mr. Chambers and a small force had just commenced operations at the time of our visit, but the indications of a good body of rich brown Hematite ore were very apparent.

New Brunswick.

Application for Letters Patent for incorporation is made by the Northern New Brunswick Mining Company, with a capital of \$200,000, in \$1 shares. The offices of the company are to be at Woodstock. The names of the shareholders are as follows, of whom the three first named are to be the first or Provincial Directors of the company under the proposed incorporation: John A. Shea, Grafton; Solomon Perley, Upper Woodstock; John Graham, Woodstock; Albert Brewer, Upper Woodstock; Frederick H. Hale, Grafton; Samuel T. Baker, Woodstock; G. Randolph Ketchum, Upper Woodstock.

Quebec.

The Montreal *Gazette* publishes a statement announcing that the Coleraine Mining company, composed of Hon. J. A. Chapleau, A. N. Montpetit, C. A. Dansereau, A. Desjardins, M.P., and others, have taken an action for \$20,000 against the Megantic Mining company. This procedure is to compel the defendants to sign a bill of sale of these mines to pay the purchase price, \$17,000, besides damages to the amount of \$3,000.

The directors of the Bell's Asbestos Co., Limited, have declared an interim dividend of 12s. 6d. per share, free of income-tax, for the half-year ending June 30th last, being at the rate of 25 per cent., per annum.

Cable announcements state that the Anglo-Canadian Asbestos company, has been registered in London, with a capital of £20,000, to carry out an agreement between the Anglo-Canadian Asbestos Co., in liquidation, and W. H. Irwin to acquire and work asbestos prop-

erties in Canada. Mr. Irwin is the London representative of the firm of Irwin & Hopper, Montreal.

We are advised that Messrs. King Bros., extensively engaged in asbestos mining in the Thetford district, have opened offices at Liverpool, under the management of Mr. C. Stuart King, for facilitating the transaction of their large mineral, timber and general business with the United Kingdom and the Continent. Mr. King, who is a nephew of the Kings, of Thetford, has been associated for eight years with Messrs. Duncan Ewing & Co., wood brokers, of Liverpool.

Mr. Thomas Mackintosh and several other Eastern Townships' gentlemen are opening up a most promising deposit of copper on Lot 22, 1st Range North of Garthby, about four miles from Garthby Station, on the line of the Quebec Central Railway. Your correspondent is informed that Mr. C. C. Colby, M.P. for Stanstead, is one of the interested parties.

Great activity is prevalent at the various asbestos mines. The demand continues strong, and satisfactory outputs are maintained. An offer of \$100 per ton for No. 1 quality was recently refused, the market price for this quality having increased to \$115 per ton, and even higher prices are obtained. Whilst the area from which this precious mineral is got is very limited, the demand continues to rapidly increase, so much so that orders cannot be executed. The Italian asbestos cannot compare with the Canadian product in quality of fibre, and as a consequence buyers are looking to this country entirely for their supplies. We are told that there is a great and growing demand for the mineral all over the continent—even in Russia.

Ontario.

The Sudbury District.

One of our Sudbury correspondents writes us that everything about the place has a quiet business-like air. There is no excitement such as formerly. Very little exploration is going on in the surrounding country, but new finds are occasionally reported. The Copper-cliff mine is now down between 450 and 500 feet. The Evans is working steadily in a good body of ore. This mine is the richest in nickel. The open workings at the Stobie were resumed as soon as the weather became mild enough in spring, and have been pushed on ever since. The total output is in excess of the smelting capacity of one furnace. The second smelter, with buildings, &c., is well advanced, and the machinery connected with it is being placed in position. The first smelter has run without a hitch and without perceptible deterioration since it started last December. Its average consumption of ore has exceeded 100 tons a day. The matte produced contains 40 per cent. and upwards of metal, 15 per cent. nickel, and 25 of iron. It is allowed to cool in the pots, and is turned out in hemispherical masses of 500 pounds each. These are broken up and barrelled for export. The roasting of the ore, under the skilful management of Dr. Fets, has been very successful and economical. The smelting has also been a marvel of cheapness, not exceeding \$2 a ton, including cost of coke. The cost at most furnaces is over \$5 a ton.

A despatch from Sudbury, under date of 16th inst., advises:—"A special train arrived here on the 13th inst., containing the following gentlemen, who are connected with

the Dominion Mining Company, of Sudbury, and whose mineral property is very extensive, both north and south of this town. There were in the party Mr. Duncan McIntyre, Mr. H. McDougall, Mr. Duncan McIntyre, Jr., Mr. John McIntyre, president, Montreal; Prof. Ferguson, Prof. Simpson, Glasgow, Scotland; Dr. Graham, Edinburgh, Scotland; Mr. George Attwood, M.E., London, Eng.; Mr. John Ferguson, North Bay, Ont. Mr. Attwood is consulting engineer in the business, and Mr. John Ferguson, of North Bay, a large property owner there, and a nephew of Mr. Duncan McIntyre, is at present residing in Sudbury, where he superintends the company's office and mining business. The whole party, on their arrival, went north to the mine now being worked in Blezard, and spent some time inspecting the property. They were highly satisfied with the results so far attained, and evidently found things looking better than they expected. The party are to have a meeting here, but will first proceed to their mines on the Algoma branch. A large building for offices, etc., is being erected."

We are favored with some excellent samples of nickeliferous chalcopyrite and argentiferous galena from the Straight Lake locations owned by Mr. Isaac Moore and other Ottawa people. A most favorable report has been made on the extent and richness of these properties by Mr. C. C. Boyd, M.E., who has also made analysis of the ores as follows:—

NICKELIFEROUS CHALCOPYRITE.

Nickel....	\$25 60	per ton, 2,000 lbs.
Gold.....	28 00	" "
Silver.....	0 45	" "
Total...	\$54 05	" "

ARGENTIFEROUS GALENA.

Gold.....	\$14 00	per ton, 2,000 lbs.
Silver.....	17 00	" "

"These samples," Mr. Boyd says, "were selected from the shaft at a few feet below the surface, and without a doubt will increase in quality, as it is fully demonstrated by the vast width of the lode that there exists inexhaustible quantities."

Simpson Bros. are down 35 to 40 feet in two shafts. At last cleaning up they got 8 pounds of platinum and considerable gold and silver. A short time ago a piece of quartz was taken out 25 pounds in weight and thickly speckled with free gold.

The Murray mine, 4 miles northwest of Sudbury, is being tested by Vivian & Co., Swansea, Wales, and their assayer is said to be well satisfied with the results.

Port Arthur District.

At Crown Point prospects are good. The Pioneer is producing rich native, and solid black silver, from the Adit. The ore is now barrelled for shipment to Nebraska. The Cumings and Montgomery mines are in good shape.

The Dawson property, eastward of Crown Point, is doing well. This property embraces R 83 and R 64. Several strong veins traverse through it, including Crown Point.

The Beaver mine, which is down 530 feet, still continues to put out a uniform quantity and quality of ore.

The Black Fox property, on location 146 T is now being worked; prospects good.

The Elgin mine is 14 feet deep, with drifts E and W, each about 140 feet long. The ore resembles the Beaver mine, and gives satisfaction in uniformity of value.

At the Lone Pine mine, miners are engaged opening up this new lode. It is situated on the Government road from Murillo to the Beaver, and about three miles from the latter place. This lode is in the Animikie series of the Cambrian formation, and gives good promise upon further development.

The Badger mine and mill are working vigorously night and day. Another shipment of this rich ore is being made, consigned to Denver, Colorado.

The Silver Star Mine operated by Mr. E. Watts, Buckingham. Drift in 90 feet—vein strong, carrying leaf and black silver.

The Mink Mountain Mine is being developed under the superintendence of Mr. Hulbert, of Duhth. The prospects are most encouraging, and when machinery is in place and the mine opened there is every reason to believe it will prove of much value.

The Silver Gleece Mine is identical with Mink Mountain, and developing very encouragingly.

On the Queen Mine drifting is being actively pushed on in a strong defined lode.

The Silver Wolverine Mine has its plant of hoisting and pumping machinery now in place. Work will be at once resumed in sinking No. 1 shaft (which is now 100 feet deep) and also No. 2 shaft which is down 33 feet. The prospects are good as rich silver has already been found on the location.

The West End Mine shows a strong and well defined fissure vein for 1,500 feet on surface, which has been somewhat developed with encouraging results.

The Shuniah Weachu or East End Silver Mountain, is busy hoisting good "pay rock" from No. 3 shaft. From No. 4 shaft ore of great value is being brought to surface. The ore is consigned to England for treatment.

North-West Territories.

The Canada Northwest Coal and Lumber Syndicate has been registered with a capital of £70,000, in order to purchase the Coal Creek and Bow River mines and other property near Calgary, and work the same. Lord Norbury, Viscount Grimston, M.P., and Sir George Baden-Powell, M.P., are among the first subscribers.

The following interesting particulars of a new and evidently rich find of oil in the North-West are from a private letter to a gentleman in Ottawa:—For eleven weeks we have been prospecting among the mountains for coal oil deposits. I am happy to say we have been eminently successful. We have located a considerable quantity of oil land, some on the Eastern slope, and some on the British Columbia side. So soon as we felt perfectly certain as to the importance of our find, we had several samples assayed. The result gave 91 per cent. lubricating oil, 5 per cent. heavy oil, 1 per cent. water, and 3 per cent. foreign matter. This is the best oil ever discovered, and far ahead of

the Pennsylvania oil fields. There is plenty of head, the flow being about 4,500 feet above the sea level, and the crude oil can be run off in pipes any distance. It is the greatest find ever known. All the oil lands are within easy distance of the railway." The letter further states that arrangements are being made for developing the find, which, if correctly reported, adds immensely to the treasure to be expected from the North-West.

The Stair Coal Mining & Manufacturing Co. have about 12 men repairing their property, and in the autumn a sufficient number of miners will be employed to give a daily output of 150 tons. This mine was first opened in 1883 by the Saskatchewan Coal Mining and Transportation Company, and is located on the north side of the South Saskatchewan river, about nine miles above Medicine Hat. The property is connected with Stair Station, on the C. P. Railway by a spur track about two miles in length. After carrying on mining operations for two seasons, this company became insolvent, and the mine was closed down, to be opened again by the lessees—Messrs. Moore & Hunter, of Winnipeg—during the winter of '86-'87. Since then nothing has been done until the present season, when this property was secured by the first named company.

There is also another company making preparations to carry on coal mining near Medicine Hat, viz: The Medicine Hat Coal Mining and Railway Company, who have secured lands on the south side of the South Saskatchewan river, and about seven miles above the town. This company have about twenty men on the ground. They commenced sinking the shaft in the latter part of April, and have now reached the depth of about two hundred feet. The coal seam, it is expected, will be found about 270 feet below the surface of the prairie. The company afterwards propose connecting their property by the spur track with the C. P. R'y at Medicine Hat.

The Galt Company are busily engaged at Lethbridge in placing hoisting machinery and other plant in connection with their first shaft in position, after which a certain proportion of the output will be taken out thereby.

Various rumors are afloat concerning the Petroleum Springs discovered within the last two months in the Kootenay district. Report has it that samples have been analysed giving from 91 to 95 % of pure oil, and free from that strong odor so objectionable in Canadian oils. A surveyor is now in that section locating claims of which some seventy are reported as being staked out.

British Columbia.

The stamps and concentrator at the Barker-ville reduction works are now in full operation. The Jack Quartz Company have shipped to the works nearly twenty tons of concentrates, assaying from \$40 to \$50 per ton. It is the intention of the Government assayer to put these through as one lot, and if successfully amalgamated it will have a tendency to encourage quartz mining. The same company have already caught \$300 in free gold on the plates. The twenty tons of concentrates and the free gold were saved from seventy tons of ore.

We understand that Mr. Moore, Inspector of Mines for Scotland, has accompanied Mr.

McLeod Stewart and others interested in the Canadian Anthracite Coal Co. to Banff, with the object of reporting fully upon the present appearance and capacity of the mines to the English capitalists who propose to invest in the concern. Should the experts' report be favorable to the enterprise, it is stated that the stock of the new company will be increased to \$5,000,000, and that the mines will be worked to their fullest capacity.

The Laura Hydraulic Mining Company (limited) is seeking incorporation, with a capital of \$20,000, for the purposes of alluvial and quartz mining in the province. The trustees mentioned in the application are John Grant, Morris Moss and Alexander Gilmore McCandless, who are to manage the concern for the first three months. The chief place of business will be at Victoria.

Another new company will be the "Kootenay No. 1 Mining Company" (foreign), with a capital of \$600,000 in 120,000 shares of \$500 each. The place of business is Ainsworth, Kootenay district. The properties to be acquired and operated are located in Oregon, Washington, Idaho, and also in British Columbia.

The Cariboo Creek Mining Co. is also seeking incorporation with a capital of \$10,000 in \$10 shares. The trustees nominated are David Woolsey, Andrew J. Smith and Thos. Forrest. The chief place of business is stated to be at Donald.

Canadian Mines on the English Market.

	Price Per Share.
General Mining, Limited £219,752 fully-paid shares of £8	4 1/4 4 1/4
Low Point, Barrasois and Ligan, \$309,100 fully-paid shares of \$100	—
Ditto, \$200,000 vendors fully-paid shares of \$100	—
North Western Coal and Navigation, Limited, £160,500 6 per cent. debentures; coupons June 30 and Dec. 31; principal 1904	—
Ditto £149,500 fully-paid ordinary shares of £10	—
Ditto £900 fully-paid deferred shares of £100	—
Sydney and Louisburg Coal and Railway, Limited, £50,000 cumulative 10 per cent. first preference shares of £10, £6 paid	7 1/2 8 1/2
Ditto, £14,560 fully-paid non cumulative 6 per cent. second pref. of £10	3
Ditto, £250,000 fully-paid ordinary shares of £10	1
New Vancouver Coal Mining and Land Co., Limited, £185,000 fully paid shares of £1	3/4 3/4
Excelsior Copper, Limited, fully-paid shares of £1	—
Ditto, shares of £1, 17s. 6d. paid	—
Shuniah Weachu, Limited, £99,888 fully-paid shares of £1	—
Silver Wolverine, Ltd., £68,465 fully-paid shares of £1	—
Anglo-Canadian Asbestos, Limited, £39,132 fully-paid shares of £2	—
Anglo-Canadian Phosphate, Limited, £46,340 fully-paid pref. shares of £10	—
Ditto, £15,050 fully-paid deferred shares of £10	—
British Columbia Smelting, Ltd., £25,000 preference shares of £1, 10s. pd.	—
Ditto £10,000 fully paid ordinary shares of £1	—
Canadian Phosphate, Ltd., £100,000 fully paid shares of £1	1/2 1/2
Bell's Asbestos, Limited, £100,000 fully paid shares of £5	17 1/2
White's Asbestos, Limited, £20,000 fully paid shares of £1	—
Ditto shares £1 paid	—
Jackson Rae Phosphate Co., Limited, £25,000 fully paid shares of £1	—
Western of Canada Oil, Limited, £200,000 fully-paid shares of £100	—
Ditto £99,850 fully-paid shares of £50	—
Ditto £199,700 12 per cent. debentures of £100	—

General Mining.—Accounts to December 31 submitted in April, but an interim meeting is held in November. Dividend for 1884, 5 per cent; for 1885 and 1886, 3 1/4 each year; and for 1887, £4 13s. 9d. per cent. Reserve fund, £29,850.

Low Point.—The vendors' shares, up to the end of 1888, do not rank for dividend until 7 per cent. per annum dividends have been paid on ordinary. Accounts to Dec. 31. For 1887, 5 per cent. was paid on the ordinary shares other than those held by the General Mining Assoc., that Company foregoing their dividend rights.

North-Western Coal.—The deferred shares receive on dividend until 15 per cent. per annum (cumulative) has been paid on the ordinary. Accounts to June 30. Dividend for 1887-8, 5 per cent.

Sydney and Louisburg Coal.—Accounts to Dec. 31 submitted about May. Out of the profits of 1884, one half-year's dividend on the first preference shares was paid. No dividend since. Debit to Dec. 31, 1887, £1,574.

Vancouver Coal.—Accounts to June 30 and December 31 submitted in November and May. In the half-year to June, 1888, there was a net profit of nearly £11,000. Debentures, £57,200. Reconstruction has been decided on.

Excelsior Copper.—Registered September 26, 1888. Authorized capital, £450,000; purchase consideration, £400,000, in cash or shares. Fully-paid shares issued to the vendor; partly paid to the public.

Shuniah Weachu.—Accounts to Nov. 20 submitted in February. No dividend yet.

Silver Wolverine.—Registered October 19, 1888, with a capital of £100,000, of which £80,000 was the first issue. Most of the shares were issued to the vendor.

Anglo-Canadian Asbestos.—The Company was registered in November, 1887. Accounts to October 31 submitted in March. No dividend yet. Debentures, £3,450. Reports are not obtainable, but this information is official.

Anglo-Canadian Phosphate.—The preference shares rank first for 7 per cent., and after a like rate has been paid on the deferred shares, both classes rank equally.

British Columbia Smelting.—The company was registered May 9, 1888. The ordinary shares were issued to the vendor, and they do not rank for dividend until the preference shares have received dividends amounting to 100 per cent.

Canadian Phosphate.—Accounts to November 30 submitted in February. Eleven months to Nov. 30, 1888, resulted in a profit of £2,576, which was carried forward.

White's Asbestos.—Registered April 9th, 1883. the authorised capital is £100,000; first issue, £60,000, of which £20,000, fully paid, was issued to the vendor.

Jackson Rae Phosphate.—Registered May 9, 1889. **Western of Canada Oil.**—Accounts to March 31 submitted in May. Debenture interest is not paid. In 1886-7 there was a profit on working of £256; in 1887-8 of £690; and in 1888-9 of £1,279. Debit balance on March 31, 1889, £900. A loan of £8,400 has been obtained on the security of £30,000 B debentures.

England's New Boiler-Inspection Bill.

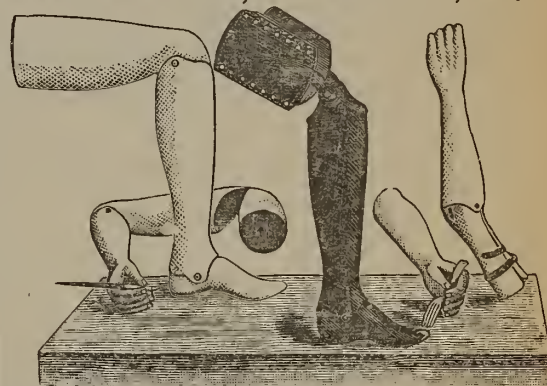
—A steam boilers bill has been introduced by Mr. Provand, Mr. O. V. Morgan, Mr. William Abraham (Mahon), and Mr. Howell, into the House of Commons. The bill provides for the compulsory periodical inspection, at the cost of, and on the responsibility of, the boiler user, of all boilers to which the Act applies; and also for registration in a Government Department of all such boilers, at a small fee, deemed sufficient to cover the expense of administering the Act. Any person working a boiler, for which he cannot produce a certificate from a duly qualified engineer, as defined in the Act, is subject to certain penalties, but the boiler user is at liberty to select any engineer he chooses, to furnish the certificate. The Act repeals the Boiler Explosion Act, 1882, but re-enacts the same modified in several particulars. The investigation of explosions of land boilers is to be dealt with by the Home Secretary's Department, as the inspector of mines, and also of factories, who are to assist in carrying out the provisions of the Act, are attached to the Home

Office. Both preliminary inquiries and formal investigations must be conducted in open court. No insurance company is allowed to grant a policy of insurance or a certificate for any boiler without proper inspection, and a policy becomes void on the expiration of cancellation of the certificate granted by such company.

Incrustation of Steam Boilers.—The incrustation of steam boilers has always been a matter of pressing importance to engineers, and many remedies have been proposed to remedy what is not only an inconvenience, but often a source of danger. The incrustation is due to the mineral matter, chiefly lime, which is contained in all hard waters and which is deposited on boiling, as we can see by looking at a tea-kettle that has been in use for only a short time. According to *Chambers' Journal*, a simple remedy has been tried by an Italian engineer, Colonel Potte, and, it is said, with complete success, in a boiler of twenty horse power, containing 126 tubes. He introduced into the boiler every week two keles (about four and one-quarter pounds) of sugar, with the result that, after four months' continuous working

only a very thin film of incrustation was formed, and this was easily removed by simple washing. Without the treatment with sugar, the same boiler had previously become incrustated in a period of six weeks. The method has the merit of simplicity and cheapness, and many will therefore be disposed to test its efficacy.

BEACOCK & CO., - - BROCKVILLE, ONT.



—Manufacturers of—
Rawhide, Artificial Limbs & Splints
Patented in the United States and Canada. Send for prices.

TAURO FOUNDRY AND MACHINE CO.

TRURO, N.S.

Engineers & Founders

OUR SPECIALTIES

— ARE —

Gold Mining Machinery

Of every kind, with latest Western Improvements.

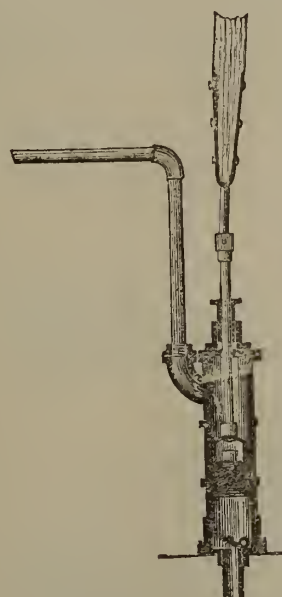
ROTARY SAW MILLS

In Latest Styles.

ALSO MANUFACTURERS OF
BOILERS & ENGINES

Iron, Bridges, Stoves,

SHIP, MILL and GENERAL CASTINGS.



G. CLISH,
Manager.

D. McDONALD,
Supt.

S. R. TUPPER,
Sec'y and Treas.

MINERS OF NOVA SCOTIA!

W. & A. MOIR,

MECHANICAL

Engineers and Machinists,
HALIFAX.

Manufacturers of

Mill and Mining Machinery,

Air and Circulating Pumps,

Hand and Power Elevators,

Marine & Stationery Engines,

And Brass and Iron Castings

of every description.



WM. STAIRS, SON & MORROW,

174 to 190 Lower Water St., Halifax, N.S.,

Importers and Dealers in all kinds of Mining Supplies, Steel Wire Ropes,

LUBRICATING OILS, EXPLOSIVES, &c. &c.

Correspondence solicited. Goods promptly supplied. Sole agent for Canada for Patent Mineral Fusible Cement.

MACDONALD & CO., Limited,

—MANUFACTURERS AND DEALERS IN—

PUMPING MACHINERY, IRON PIPES, FITTINGS, &c., FOR MINERS' USE.

Call or Write us for Prices.

HALIFAX, N.S.

RUSSELL & CO.

PROVINCIAL AND DOMINION

LAND SURVEYORS,
CIVIL AND MINING ENGINEERS,
PORT ARTHUR, ONTARIO.

Mining Properties Surveyed, Reported on and Dealt in

Latest and Most Complete Plans of Thunder Bay
Mining District Always on Hand.

A. L. RUSSELL, A. H. MACDOUGLL, W. W. RUSSELL
P. L. S., D. L. S. P. L. S., D. L. S. M.E.A.MCAN.SOC.C.E



MONEY ORDERS.

MONEY ORDERS may be obtained at any Money Order Office in Canada, payable in the Dominion; also in the United States, the United Kingdom, France, Germany, Italy, Belgium, Switzerland, Sweden, Norway, Denmark, the Netherlands, India, the Australian Colonies, and other countries and British Colonies generally.

On Money Orders payable within Canada the commission is as follows:

If not exceeding \$4.....	2c.
Over \$4, not exceeding \$10.....	5c.
" 10, " " 20.....	10c.
" 20, " " 40.....	20c.
" 40, " " 60.....	30c.
" 60, " " 80.....	40c.
" 80, " " 100.....	50c.

On Money Orders payable abroad the commission is:

If not exceeding \$10.....	10c.
Over \$10, not exceeding \$20.....	20c.
" 20, " " 30.....	30c.
" 30, " " 40.....	40c.
" 40, " " 50.....	50c.

For further information see OFFICIAL POSTAL GUIDE.

Post Office Department, Ottawa.
15th Sept., 1883.

LEDOUX & COMPANY,

10 CEDAR ST., NEW YORK.

Engineers, Metallurgists &
Assayers.

Public Ore Sampling & Storage Works

All the principal buyers of furnace materials in the world purchase and pay cash against our certificates of assay, through New York banks.

By special permission of the Secretary of the Treasury of the United States, cars of ore or copper matte passing through in bond can be opened and sampled at our works.

Consignments received and sold to highest bidder. Send for circular giving full particulars.

Mines examined and sampled. Assays and Analyses of all kinds.



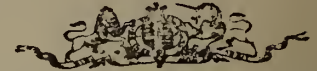
NOTICE

Is hereby given that all communications in respect to matters affecting the Department of Indian Affairs should be addressed to the Honorable E. Dewdney as Superintendent General of Indian Affairs, and not as Minister of the Interior, or to the undersigned. All Officers of the Department should address their official letters to the undersigned.

L. VANKOUGHNET,

Deputy Superintendent-General
of Indian Affairs.

Department of Indian Affairs,
Ottawa, 11th May, 1889.



SEALED TENDERS addressed to the undersigned and addressed "Tender for Post Office, etc., Lachine, P.Q.," will be received at this office until Friday, 15th September, for the several works required for the erection of Post Office, etc., Lachine, P.Q.

Specifications can be seen at the Department of Public Works, Ottawa, and at the Corporation offices at Lachine, P.Q., on and after Friday, 23rd August, 1889, and tenders will not be considered unless made on form supplied and signed with actual signatures of tenderers.

An accepted bank cheque, payable to the order of the Minister of Public Works equal to five per cent. of amount of tender, must accompany each tender. This cheque will be forfeited if the party declines the contract, or fail to complete the work contracted for, and will be returned in case of non-acceptance of tender.

The Department does not bind itself to accept the lowest or any tender.

By order,
A. GOBEIL,
Secretary.

Department of Public Works,
Ottawa, August, 1889.

CENTRAL CANADA FAIR,

UNDER THE AUSPICES OF THE

Central Canada Exhibition Association,

WILL BE HELD

AT OTTAWA,

—FROM—

9th to 14th SEPT., 1889.

PREMIUMS \$12,000 OFFERED

BESIDES MEDALS, ETC.

As will be seen from the Prize List now ready, special inducements are offered for exhibits of the

ECONOMIC MINERALS OF CANADA

UNDER THE FOLLOWING SECTIONS:

1. Metals and their Ores.
2. Mineral Manures.
3. Mineral Pigments.
4. Salt. Brines and Mineral Waters.
5. Materials applicable to Common and Decorative Construction.
6. For the production of Light and Heat.
7. Refractory Materials.
8. Fine Arts and Jewellery.
9. Photographs, Maps, Plans, &c., of Mines, Working Machinery, Buildings, &c.

A Medal will also be awarded for the

BEST COLLECTION and DISPLAY.

For Prize Lists, Programmes and other information apply to

R. C. W. MacCuaig,
C. MAGEE, SECRETARY,
PRESIDENT. Ottawa.



CRUDE AND MANUFACTURED FOR ALL PURPOSES.



Cloths, Facings, Furnace Cements, Paper, Stove Linings, &c.

SPECIALTIES: FIRE-VELT, a flexible Asbestos Sheet, made in tubular sections and rolls, best and most durable non-conductor made. SUPERATOR, a strong fire & waterproof fabric for sheathing & roofing buildings, fire proofing boiler rooms, &c.

THE CHALMERS-SPENCE CO.,

419 TO 425 EIGHTH ST., NEW YORK.

ASBESTOS.

VALUABLE PLUMBAGO

AND OTHER

Mineral Lands FOR SALE,

IN THE TOWNSHIP OF BUCK-
INGHAM, COUNTY OF
OTTAWA.

1st.—Lot 28, in the 6th range, containing 100 acres, in addition to the salina of the lake.

2nd.—North half of lot 23, in the 5th range, containing 100 acres.

3rd.—Nine acres of lot No. 28, in the 5th range, with water privileges thereto appertaining, being site of mill dam, etc., etc.

The property formerly belonged to the Montreal Plumbago Mining Company, and was worked successfully for several years, until the company's mill was destroyed by fire, but the mill dam remains almost uninjured, and there are on the property several houses, sheds, etc., built for various purposes when mining operations were carried out.

The Plumbago Deposits

upon the property are regarded as amongst the richest and most extensive in the Dominion. As to the quality of the Plumbago, it has been extensively used in the manufacture of crucibles, lubricating leads, stove polish, etc., etc., and given unbounded satisfaction. This is established by the experience of consumers, and by a certificate from the celebrated Battersea Crucible Works, London, England, a copy of which is open for inspection.

MICA

has also been discovered in quantity

The lands are in the Phosphate region, and recent prospecting has disclosed a rich and extensive deposit of this mineral. There are unrivalled facilities for transporting the ore to and from the mines by the Ottawa River and C. P. Railway. Distance from mines to Railway Station 6 miles. Good road.

All that is required to make these valuable mines handsomely remunerative is a little capital and enterprise.

The Title is Indisputable.

For information apply to

WM. H. DICKSON,
160 Waller St., Ottawa.

H. E. DICKSON,
Russell House, Ottawa.

OR TO THE OFFICE OF

THE CANADIAN MINING REVIEW.
OTTAWA.

SHIPMAN ENGINES, ACME MODEL. COAL OIL FOR FUEL.



To parties requiring a safe, reliable, durable and economical Steam Launch, from 20x4 to 35x7 with ample power to give satisfactory speed can supply the best on the market and at prices which will defy competition for a like quality of goods. We have a full staff of competent boat and engine builders and guarantee every article to be strictly first class. Hundreds of our engines from 1 to 12 h. p. Marine or Stationary have been in use for years and are acknowledged superior to all others. No smoke, dirt or sparks, no manual or mechanical labor necessary. Yet have the privacy of your launch for your family. As the water and oil supply is automatic very little attention is required. But a few minutes is necessary to get up 100 lbs. of steam; when you return to the boat house by turning a hand wheel all fire is extinguished. Orders for coming season should be placed at once, as the demand is much in excess of previous years. Write for 1889 circulars giving prices, testimonials, etc. No attention paid to postal cards.

JOHN GILLIES & CO., Carleton Place, Ont.



Mines, Elevators, Inclines, &c.

GALVANIZED GUY ROPE. BRIDGE CABLES.
HAWSER ROPES.

WIRE of all kinds. Insulated WIRE

John A. Roebling's Sons Co.

117 & 119 LIBERTY St., NEW YORK.

H. L SHIPPY Sec'y.

PHOSPHATES, PHOSPHATIC MANURES, AGRICULTURAL FERTILIZERS

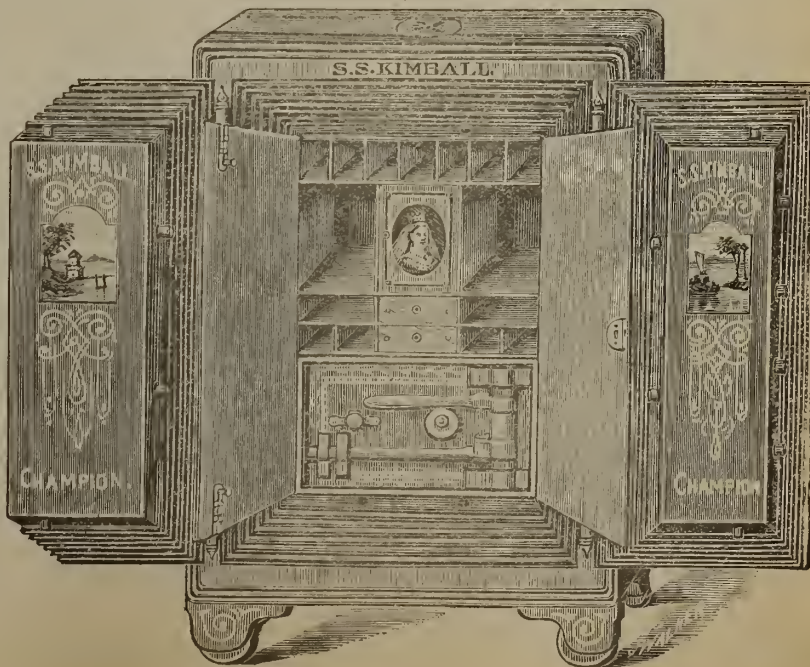
Readers of the REVIEW desiring extra copies of SCIENTIFIC AGRICULTURE should SEND IN THEIR ORDERS NOW. A few SPACES are still open and contracts may be made at reasonable rates. Address Manager, THE CANADIAN MINING REVIEW, OTTAWA.

Champion Fire and Burglarproof Safes.

These Safes have the best record of any in the Dominion. Price 30 per cent. cheaper than any other first-class Safe.

SEND FOR CATALOGUE AND PRICE-LIST.

S. S. KIMBALL,
577 Craig St., Montreal.





DEPARTMENT

OF

Inland Revenue.

AN ACT RESPECTING AGRICULTURAL FERTILIZERS.

The public is hereby notified that the provisions of the Act respecting AGRICULTURAL FERTILIZERS came into force on the 1st of January, 1886 and that all Fertilizers sold thereafter require to be sold subject to the conditions and restrictions therein contained—the main features of which are as follows:

The expression "fertilizer" means and includes all fertilizers which are sold at more than TEN DOLLARS per ton, and which contains ammonia, or its equivalent of nitrogen, or phosphoric acid.

Every manufacturer or importer of fertilizers for sale, shall, in the course of the month of January in each year, and before offering the same fertilizer for sale, transmit to the Minister of Inland Revenue, carriage paid, a sealed glass jar, containing at least two pounds of the fertilizer manufactured or imported by him, with the certificate of analysis of the same, together with an affidavit setting forth that each jar contains a fair average sample of the fertilizer manufactured or imported by him; and such sample shall be preserved by the

Minister of Inland Revenue for the purpose of comparison with any sample of fertilizer which is obtained in the course of the twelve months then next ensuing from such manufacturer or importer, or collected under the provisions of the Adulteration Act, or is transmitted to the chief analyst for analysis.

If the fertilizer is put up in packages, every such package intended for sale or distribution within Canada shall have the manufacturer's certificate of analysis placed upon or securely attached to each package by the manufacturer; if the fertilizer is in bags, it shall be distinctly stamped or printed upon each bag; if it is in barrels, it shall be either branded, stamped or printed upon the head of each barrel or distinctly printed upon good paper and securely pasted upon the head of each barrel, or upon a tag securely attached to the head of each barrel; if it is in bulk, the manufacturer's certificate shall be produced and a copy given to each purchaser.

No fertilizer shall be sold or offered or exposed for sale unless a certificate of analysis and sample of the same shall have been transmitted to the Minister of Inland Revenue and the provisions of the foregoing sub-section have been complied with.

Every person who sells or offers or exposes for sale any fertilizer, in respect of which the provisions of this Act have not been complied with—or who permits a certificate of analysis to be attached to any package, bag or barrel of such fertilizer, or to be produced to the inspectors to accompany the bill of inspection of such inspector, stating that the fertilizer contains a larger percentage of the constituents mentioned in sub-section No. 11 of the Act than is contained therein—or who sells, offers or exposes for sale any fertilizer purporting to have been inspected, and which does not contain the percentage of constituents mentioned in the next preceding section—or who sells or offers or exposes for sale any fertilizer which does not contain the per-

centage of constituents mentioned in the manufacturer's certificate accompanying the same, shall be liable in each case to a penalty not exceeding fifty dollars for the first offence, and for each subsequent offence to a penalty not exceeding one hundred dollars. Provided always that deficiency of one *per centum* of the ammonia, or its equivalent of nitrogen, or of the phosphoric acid, claimed to be contained, shall not be considered as evidence of fraudulent intent.

The Act passed in the forty-seventh year of Her Majesty's reign, chaptered thirty-seven and entitled, "*An Act to prevent fraud in the manufacture and sale of agricultural fertilizers*," is by this Act repealed, except in regard to any offence committed against it or any prosecution or other act commenced and not concluded or completed, and any payment of money due in respect of any provision thereof.

A copy of the Act may be obtained upon application to the Department of Inland Revenue, as well as a copy of a Bulletin which it is proposed to issue in April, 1888, concerning the fertilizers

E. MIALL,
Commissioner.

January, 1889.

PROPERTIES FOR SALE.

Parties having developed or undeveloped mineral lands for sale will find the REVIEW an admirable medium for bringing them before the notice of CAPITALISTS and INVESTORS in GREAT BRITAIN and the UNITED STATES.

Intercolonial Railway
OF CANADA.

The direct route between the West and all points on the St. Lawrence and Baie des Chaleur, Province of Quebec; also for New Brunswick, Nova Scotia, Prince Edward, Cape Breton and the Magdalene Islands, Newfoundland and St. Pierre.

EXPRESS TRAINS leave Montreal and Halifax daily (Sunday excepted) and run through without change between these points in 30 hours.

The Through Express Train cars of the Intercolonial Railway are brilliantly lighted by electricity and heated by steam from the locomotive.

New and Elegant Buffet Sleeping and Day Cars are run on all through Express Trains.

The popular Summer Sea Bathing and Fishing Resorts of Canada are along the Intercolonial, or are reached by that route.

CANADIAN EUROPEAN MAIL
AND PASSENGER ROUTE.

Passengers for Great Britain or the Continent by leaving Montreal on Thursday morning will join Outward Mail Steamer at Rimouski the same evening.

The attention of shippers is directed to the superior facilities offered by this route for the transport of flour and general merchandise intended for the Eastern Provinces and Newfoundland; also for shipments of grain and produce intended for the European market.

Tickets may be obtained and all information about the route, also Freight and Passenger rates, on application to

G. W. ROBINSON,
Eastern Freight and Passenger Agent,
137½ St. James St., MONTREAL.

E. KING,
27 Sparks Street,
OTTAWA.

D. POTTINGER,
Chief Superintendent.

Railway Offices, Moncton, N.B.
2nd July, 1889.

The Polson Iron Works Co'y
TORONTO, ONT.

Manufacturers of the Celebrated "Brown Automatic Engine."

GENERAL DEALERS IN

MINING MACHINERY.

SPECIAL AGENTS FOR

Knowles' Steam Pumps,

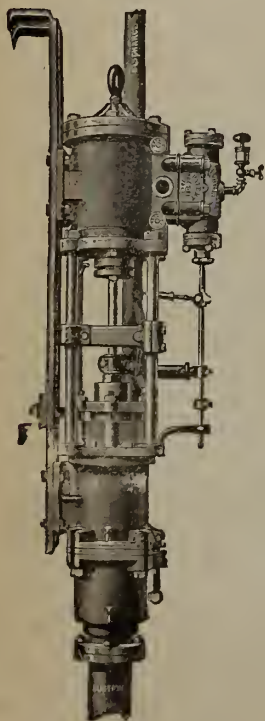
B. T. Sturtevant's Blowers and Fans,

Burleigh Rock Drills.

Hoisting Engines and Boilers, Quartz Mills, Diamond Prospecting Drills, Rock Breakers.

Office and Works, Esplanade E.; Warehouse, 38 Yonge St.,

TORONTO.





Mining Regulations

TO GOVERN THE DISPOSAL OF

Mineral Lands other than Coal Lands, 1886.

THESE REGULATIONS shall be applicable to all Dominion Lands containing gold, silver, cinnabar, lead, tin, copper, petroleum, iron or other mineral deposits of economic value, with the exception of coal.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein either by surface or subterranean prospecting for mineral deposits, with a view to obtaining under the Regulations a mining location for the same but no mining location or mining claim shall be granted until the discovery of the vein, lode or deposit of mineral or metal within the limits of the location or claim.

QUARTZ MINING

A location for mining, except for iron on veins, lodes or ledges of quartz or other rock in place, shall not exceed forty acres in area. Its length shall not be more than three times its breadth and its surface boundary shall be four straight lines, the opposite sides of which shall be parallel, except where prior locations would prevent, in which case it may be of such a shape as may be approved of by the Superintendent of Mining.

Any person having discovered a mineral deposit may obtain a mining location therefor, in the manner set forth in the Regulations which provides for the character of the survey and the marks necessary to designate the location on the ground.

When the location has been marked conformably to the requirements of the Regulations, the claimant shall within sixty days thereafter, file with the local agent in the Dominion Land Office for the district in which the location is situated, a declaration or oath setting forth the circumstances of his discovery, and describing, as nearly as may be, the locality and dimensions of the claim marked out by him as aforesaid; and shall, along with such declaration, pay to the said agent an entry fee of FIVE DOLLARS. The agent's receipt for such fee will be the claimant's authority to enter into possession of the location applied for.

At any time before the expiration of FIVE years from the date of his obtaining the agent's receipt it shall be open to the claimant to purchase the location on filing with the local agent proof that he has expended not less than FIVE HUNDRED DOLLARS in actual mining operations on the same; but the claimant is required, before the expiration of each of the five years, to prove that he has performed not less than ONE HUNDRED DOLLARS' worth of labor during the year in the actual development of his claim, and at the same time obtain a renewal of his location receipt, for which he is required to pay a fee of FIVE DOLLARS.

The price to be paid for a mining location shall be at the rate of FIVE DOLLARS PER ACRE, cash, and the sum of FIFTY DOLLARS extra for the survey of the same.

No more than one mining location shall be granted to any individual claimant upon the same lode or vein.

IRON.

The Minister of the Interior may grant a location for the mining of iron, not exceeding 160 acres in area which shall be bounded by north and south and west lines astronomically, and its breadth shall equal its length. Provided that should any person making an application purporting to be for the purpose of

mining iron thus obtain, whether in good faith or fraudulently, possession of a valuable mineral deposit other than iron, his right in such deposit shall be restricted to the area prescribed by the Regulations for other minerals, and the rest of the location shall revert to the Crown for such disposition as the Minister may direct.

The regulations also provide for the manner in which land may be acquired for milling purposes, reduction works or other works incidental to mining operations.

Locations taken up prior to this date may, until the 1st of August, 1886, be re-marked and re-entered in conformity with the Regulations without payment of new fees in cases where no existing interests would thereby be prejudicially affected.

PLACER MINING.

The Regulations laid down in respect to quartz mining shall be applicable to placer mining as far as they relate to entries, entry fees, assignments, marking of localities, agents' receipts, and generally where they can be applied.

The nature and size of placer mining claims are provided for in the Regulations, including bar, dry, bench creek or hill diggings, and the RIGHTS AND DUTIES OF MINERS are fully set forth.

The Regulations apply also to

BED-ROCK FLUMES, DRAINAGE OF MINES AND DITCHES.

The GENERAL PROVISIONS of the Regulations include the interpretation of expressions used therein; how disputes shall be heard and adjudicated upon; under what circumstances miners shall be entitled to absent themselves from their locations or diggings, etc., etc.

THE SCHEDULE OF MINING REGULATIONS

Contains the forms to be observed in the drawing up of all documents such as:— "Application and affidavit of discoverer of quartz mine." "Receipt for fee paid by applicant for mining location." "Receipt for fee on extension of time for purchase of a mining location." "Patent of a mining location." "Certificate of the assignment of a mining location." "Application for grant for placer mining and affidavit of applicant." "Grant for placer mining." "Certificate of the assignment of a placer mining claim." "Grant to a bed rock flume company." "Grant for drainage." "Grant of right to divert water and construct ditches."

Since the publication, in 1884, of the Mining Regulations to govern the disposal of Dominion Mineral Lands the same have been carefully and thoroughly revised with a view to ensure ample protection to the public interests, and at the same time to encourage the prospector and miner in order that the mineral resources may be made valuable by development.

COPIES OF THE REGULATIONS MAY BE OBTAINED UPON APPLICATION TO THE DEPARTMENT OF THE INTERIOR

A. M. BURGESS,

Deputy Minister of the Interior.

SEND FOR SAMPLES AND PRICES FOR

Asbestos Bags, Phosphate Bags, Ore Bags, &c.,

SPECIAL SIZES MADE TO ORDER.

DOUBLE SEWN.

DICK, RIDOUT & CO.,

PROPRIETORS TORONTO BAG WORKS,

Office and Warehouse: 11-13 Front St. East. Factory: 14, 16, 18, 20, 22 Bay St.

ESTABLISHED 1887.

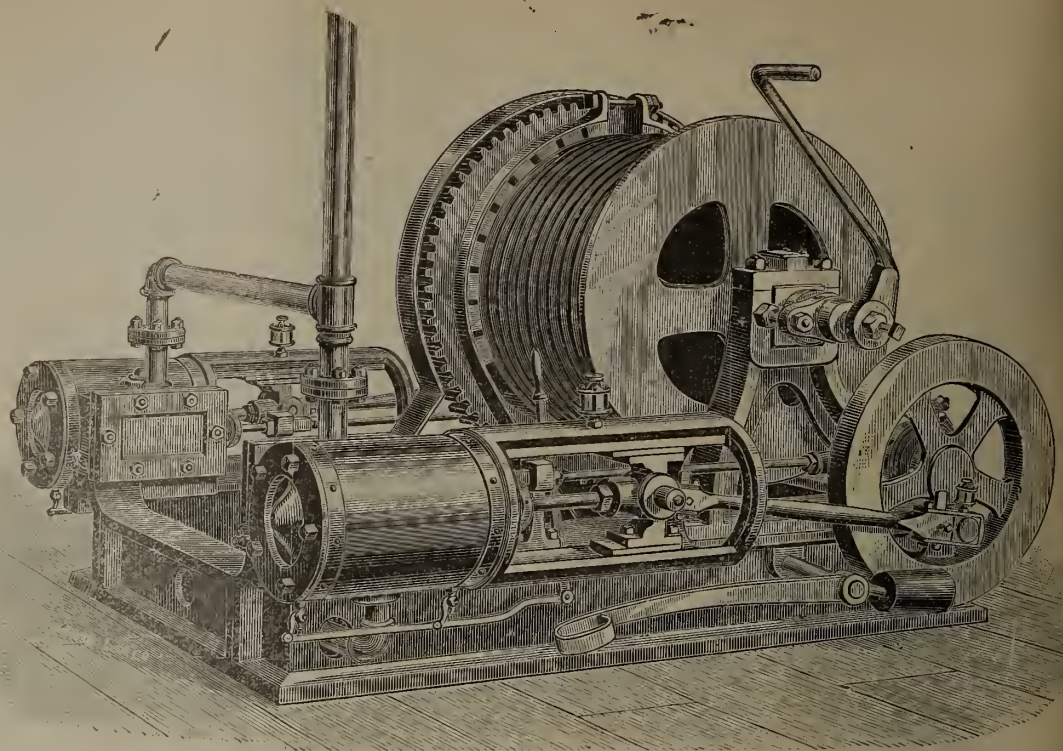
TORONTO.

JOHN DOTY ENGINE CO.

Toronto, Ont.

MANUFACTURERS OF

Mining & General
Machinery.



HOISTING ENGINES

—: FOR :—

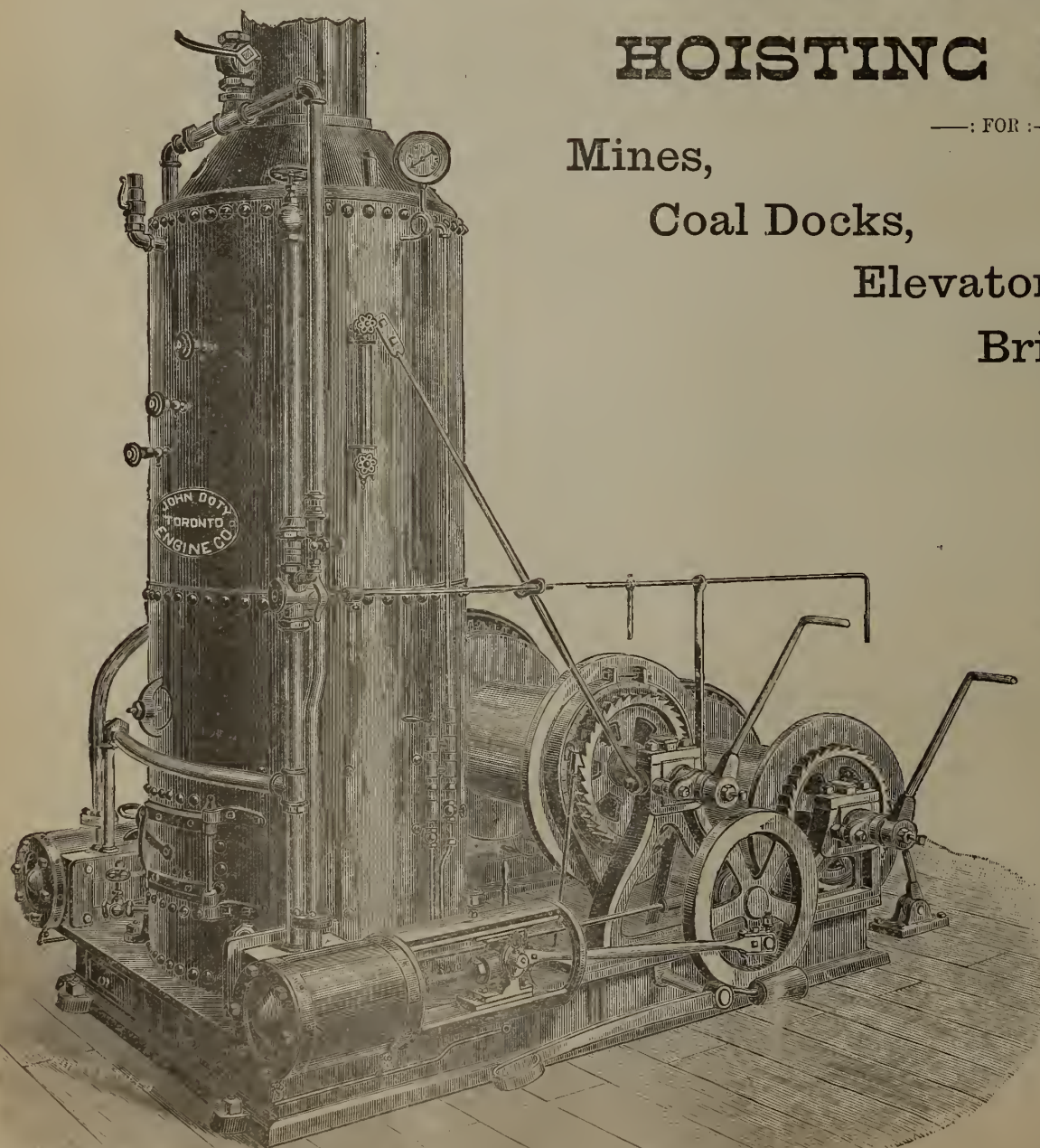
Mines,

Coal Docks,

Elevators,

Bridge Builders,

Contractors, &c.



CORLISS ENGINES

Tug & Steam Yacht Engines,

Mill Engines.

Shafting & Mill
Gearing.

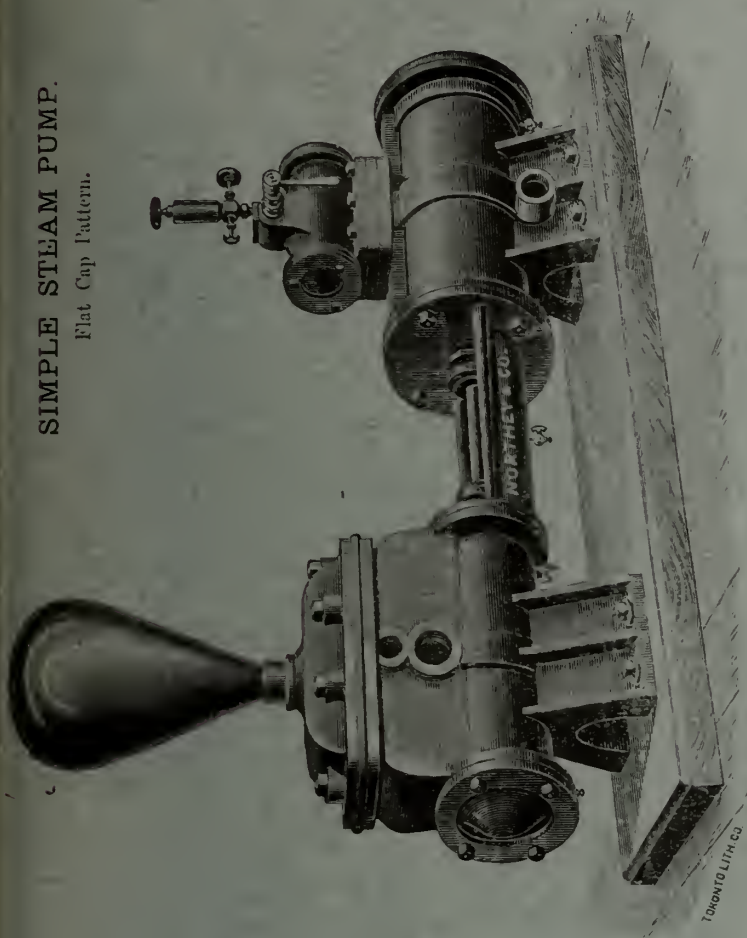
All Descriptions of Boiler
and Tank Work.

Send for Estimates and
Catalogues.

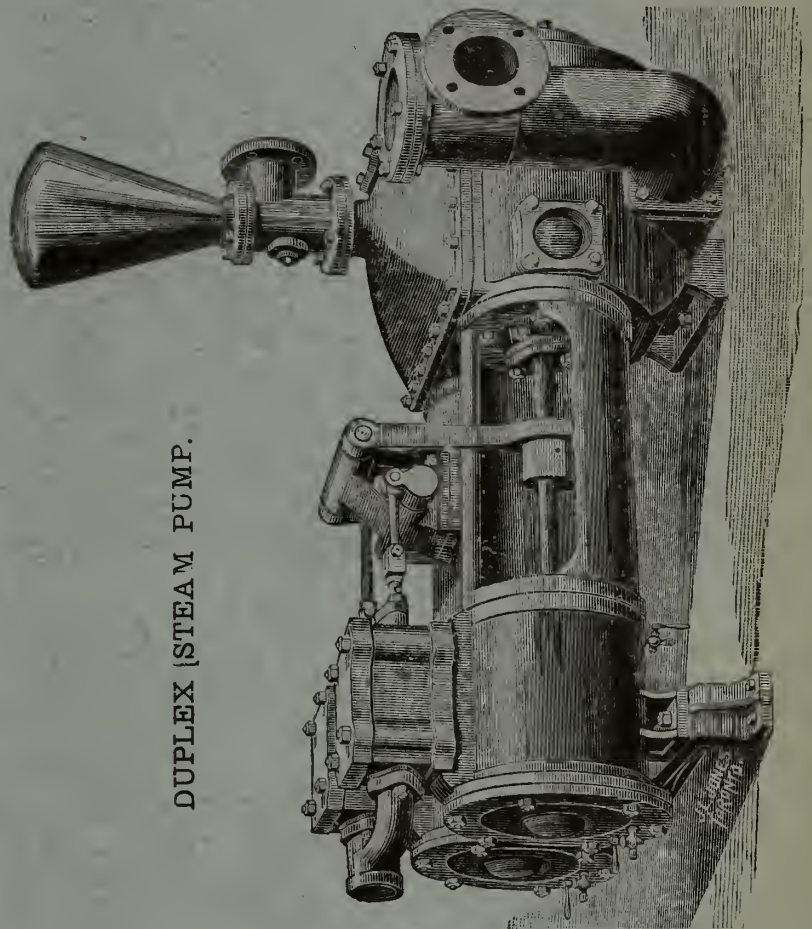
Northey & Co's Steam Pump Works, TORONTO, ONT.

SIMPLE STEAM PUMP.

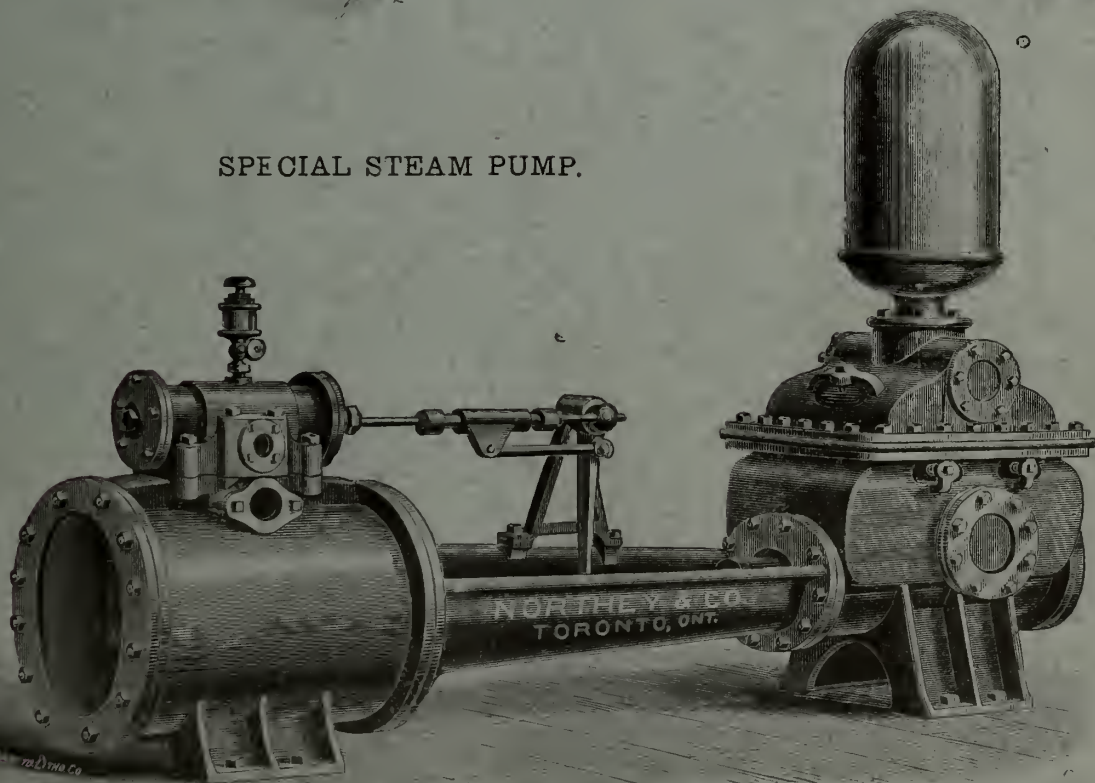
Flat Cap Pattern.



DUPLEX STEAM PUMP.

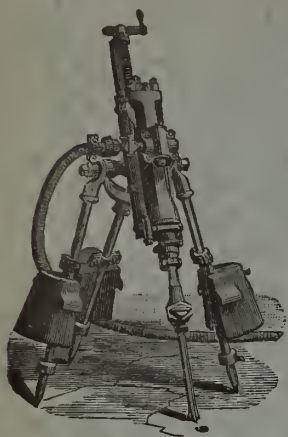


SPECIAL STEAM PUMP.



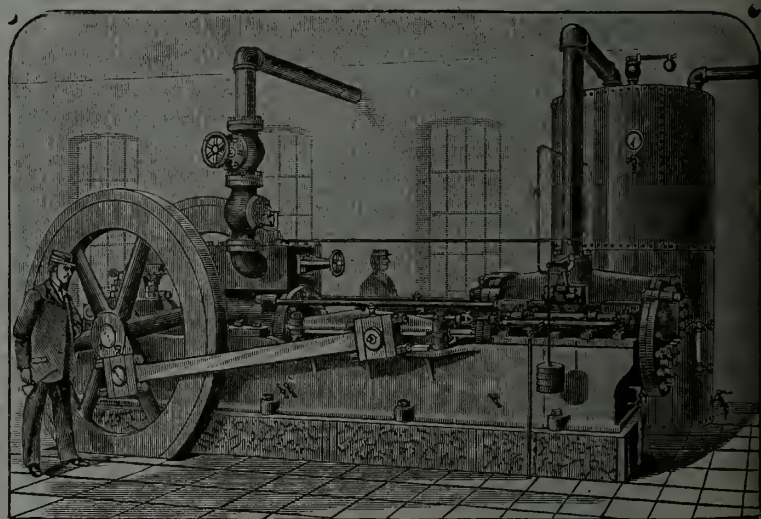
Steam Pumps of the best and latest designs for mining purposes, Boiler Feeding, Fire Protection, and General Water Supply, etc.

NORTHEY & CO.,
Mechanical AND Hydraulic Engineers, Toronto, Ont.
WORKS—COR. FRONT AND PARLIAMENT STS.

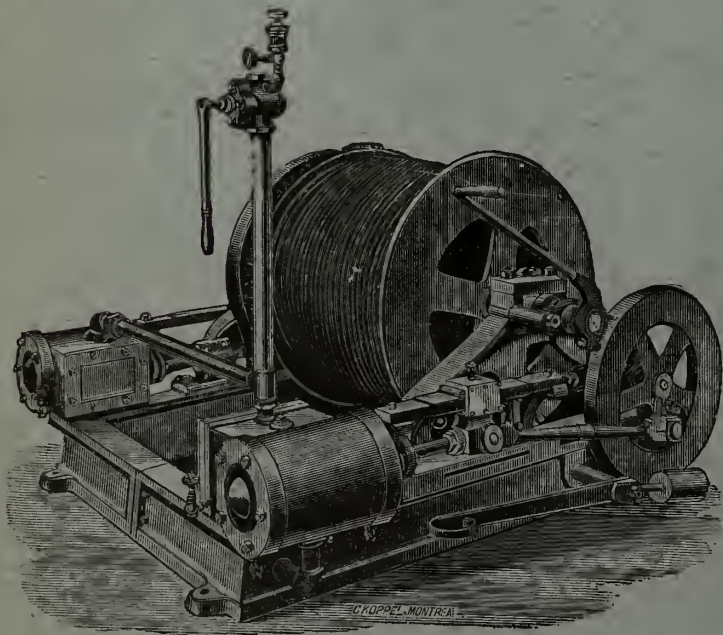


INGERSOLL
ROCK DRILL COMP'Y
OF CANADA
MANUFACTURERS OF

Rock Drills,
Air Compressors,
Steam & Horse Power Hoists,
BOILERS,
GENERAL MINING
Quarrying Machinery
Contractors' Plant.



— ALSO —



Drill Steel, Wire Rope,
Derrick Castings,
Steam & Air Hose & Couplings,
Iron Piping, Fittings,
ALL KINDS OF SUPPLIES
—FOR—
Miners & Contractors' Work.

For Estimates, Catalogues and information address

Ingersoll Rock Drill Co. of Canada

204 St. James St., or P.O. Box 1942, Montreal.

FACTS FOR THE FARMER.

AGRICULTURAL FERTILIZERS,
PHOSPHATES,
PHOSPHATIC MANURES.

SUPPLEMENT TO THE CANADIAN MINING REVIEW.
ESTABLISHED 1882.

HAMILTON POWDER COMPANY

Manufacture Mining, Blasting, Military and Sporting Gunpowder, Dynamite, Daulin, and the New Eclipse Mining Powder.

DOMINION AGENTS FOR SAFETY FUSE, ELECTRIC BLASTING APPARATUS, ETC.

OFFICE.—103 St. Francois Xavier Street, Montreal. Branch Offices and Magazines at all Chief Distributing points in Canada.

Important to Miners, Contractors and Quarrymen.

Ingersoll Rock Drill Company, of Canada,

MANUFACTURERS OF

ROCK DRILLS, AIR COMPRESSORS,

Horse Power and Steam Boilers,

Boilers, Stone Channellers, Gadders; also dealers in Wire Rope, Drill Steel, Derrick Castings, Steam Water and Air Pipe and Fittings, Steam and Air Hose, Pumps, Mining Rails, Dump Cars and Buckets; all kinds of Mining and Quarrying Machinery.

Write for Estimates. All information cheerfully given.

OFFICE :—204 ST. JAMES STREET,

MONTREAL.

PIANOS AND ORGANS

STANDARD MAKERS OF THE WORLD.

CHICKERING, STEINWAY,
HAINES, EVERETT,
and NORDHEIMER PIANOS,
ESTEY and KIMBALL ORGANS.

A. & S. NORDHEIMER,

SOLE AGENTS,

69 SPARKS STREET, OTTAWA.

N.B.—A large assortment of good Instruments, slightly used, at greatly reduced prices. Terms very liberal.

THE CANADIAN BANK OF COMMERCE

ESTABLISHED 1867.

Capital, \$6,000,000 - - - Rest, \$700,000.

OTTAWA BRANCH:

R. GILL, - - - MANAGER.

Attention is specially directed to the advantages afforded by the SAVINGS BANK DEPARTMENT established for the convenience of the public at the Branch of this Bank at Ottawa. Deposits of ONE DOLLAR and upwards will be received and interest allowed at current rates.

Deposit Receipts will as heretofore be issued on favorable terms, and current accounts opened, and Loans negotiated, as usual. The Bank offers to its depositors the security of its Paid-up Capital and Rest, amounting in all to Six Million, Seven Hundred Thousand Dollars (\$6,700,000). In respect to Capital the Canadian Bank of Commerce is the second largest on the Continent of America.

Drafts are issued payable in all parts of Canada, including British Columbia, the North-West, and the Maritime Provinces; also drafts on Chicago, San Francisco, and Portland, Oregon, and Hamilton, Bermuda. Drafts are also issued on the Bank's Correspondents in Great Britain and the Continent of Europe, and Letters of Credit for use in all parts of the world.

Having by far the largest number of Branches in Ontario and Quebec of any Bank, exceptional facilities are offered to its Customers and Correspondents for their collecting business.

NOTICE THE FOLLOWING ADVANTAGES

OF OUR

SAVINGS BANK DEPARTMENT:

1. INTEREST is added to the principal at the end of the months of May and November in each year.
2. MONEY bears interest from the date it is left in the Bank.
3. NO CHARGE is made on withdrawing or depositing money.
4. THE DEPOSITOR is subject to no delay whatever.

THE ONTARIO BANK

CAPITAL PAID-UP, - - - - - \$1,500,000
RESERVE FUND, - - - - - 575,000

HEAD OFFICE, - - - - - TORONTO

DIRECTORS:

SIR WM. P. HOWLAND, C.B., K.C.M.G., President.
R. K. BURGESS, Esq., Vice-President.
Hon. C. F. Fraser, A. M. Smith, Esq.,
G. M. Rose, Esq., Donald Mackay, Esq.,
G. R. R. Cockburn, Esq.

C. HOLLAND, - - - - - General Manager

BRANCHES:

Aurora, Montreal, Pickering,
Bowmanville, Mount Forest, Toronto,
Cornwall, Newmarket, Whitby,
Guelph, Ottawa, 480 Queen St.
Kingston, Peterboro', West, Toronto.
Lindsay, Port Arthur.

AGENTS:

London, Eng.—Alliance Bank, [Limited].
France and Europe.—Credit Lyonnais.
New York.—The Bank of the State of New York, and
Messrs Walter Watson and Alex. Lang.
Boston—Tremont National Bank.

UNION BANK OF CANADA.

Capital paid up \$1,200,000
Reserve Fund 150,000

DIRECTORS.—Andrew Thomson, Esq., President;
Hon. E. J. Price, Vice-President; D. C. Thomson,
Esq., Hon. Thos. McGreevy, Ed. Giroux, Esq., E. J.
Hale, Esq., Sir A. T. Galt, G.C.M.G., E. E. Webb,
Cashier.

OFFICES.—Alexandria, Ont.; Smith's Falls, Ont.;
Iroquois, Ont.; Toronto, Ont.; Lethbridge, N.W.T.;
West Winchester, Ont.; Merrickville, Ont.; Winnipeg,
Man.; Montreal, Que.; Quebec, Que.; Ottawa, Ont.
M. A. ANDERSON, Manager.

Foreign Agents throughout Great Britain and the
United States. English and American Exchange bought
and sold. Interest allowed on deposits.

H. R. IVES & CO., MONTREAL,

MANUFACTURERS OF

COMPOSITE IRON GATES, CRESTINGS, STABLE FURNITURE,

ARCHITECTURAL IRON WORK OF EVERY DESCRIPTION, HARDWARE, STOVES, IRON BEDSTEADS, SOIL PIPE, &c.



SEND FOR CUTS AND PRICES OF

Iron Fences, Crestings, Stable Fittings, &c., &c.

TRADE MARK

FOR

BARB WIRE

FENCING.



TO FARMERS.

Enquire for "Buffalo
Brand," made by Can-
ada Wire Company.

"BUFFALO," : STOVES : AND : RANGES.

The best made. For sale by all dealers.

H. R. IVES & CO.,

Show Rooms Cor. Queen and William Sts.,

MONTREAL.

THE MERCHANTS BANK

OF CANADA.

Capital Paid-up, - - - - - \$5,799,200
Reserve Fund - - - - - 2,135,000

Head Office - Montreal.

BOARD OF DIRECTORS

ANDREW ALLAN, Esq., - President.
ROBT. ANDERSON, Esq., Vice-President.

Hector Mackenzie, Esq. John Duncan, Esq.
Jonathan Hodgson, Esq. J. P. Dawes, Esq.
H. Montagu Allan, Esq. John Cassils, Esq.
T. H. Dunn, Esq.

GEORGE HAGUE, - - - - - General Manager.
John Gault, Supt. of Branches.

OTTAWA BRANCH.

W. LAKE MARLER, Manager.

BANK OF OTTAWA, OTTAWA.

Capital (all paid-up).....\$1,000,000
Rest.....360,000

JAMES McLAREN, Esq., President.
CHARLES MAGER, Esq., Vice-President.
DIRECTORS.—R. Blackburn, Esq., Hon. Geo. Bryson,
Hon. R. L. Church, Alex. Fraser, Esq., Geo. Hay, Esq.,
John Mather, Esq.

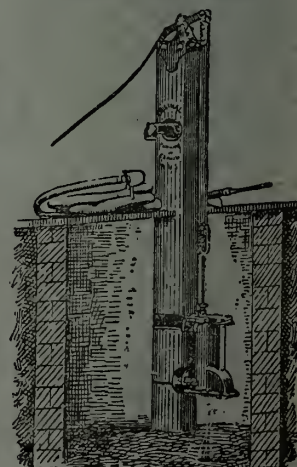
GEO. BURN, Cashier.

Branches — Amprior, Pembroke, Winnipeg, Man.,
Carleton Place, Ont., Keewatin, Ont.
Agents in Canada, New York and Chicago, Bank of
Montreal. Agents in London, Eng., Alliance Bank.

ORIGINAL DOUBLE ACTING Non-Freezing Force Pump!

Original Force Pump.

With Wrought Iron Adjustable Handles.



With Wrought Iron Adjustable Handles.

Patented Canada and U.S.
LOOK NO LONGER

For water to prime your pumps, or for salt, nor water or
hot irons to thaw them out in winter. Buy our Original
Double-Acting NON-FREEZING FORCE PUMP. They never need priming, never freeze, and are not
liable to get out of repair, have double acting iron cylin-
der, and will throw a barrel of water a minute. We also
make a specialty of pumps for Threshing Machines,
Tanks, Drilled Wells, &c., &c. The superior merits of
these pumps over all others now in use are making a re-
putation that cannot be gainsaid. These Pumps are
offered solely on their merits.

Agents wanted in every county. A liberal commission
given or salaries paid to good men. Write for prices
and discounts. Address

THE FARMERS' SUPPLY CO.,
PRESCOTT, ONT.

The Canadian Mining Review

CONDUCTED BY . . . B. T. A. BELL

OFFICES:

UNION CHAMBERS, 14 Metcalfe St.

OTTAWA.

EXHIBITION NUMBER.

Artificial Fertilizers.

By Francis Wyatt, Ph. D.

Chemistry may be described as that branch of science which investigates into the nature and properties of the elements of matter, and determines the manner in which they react upon, and combine with each other. If we hand over a grain of wheat to the botanist, he can discern in it nothing but a tiny, yellow, opaque and brittle seed, whereas, if we pass it to the chemist, he will discover by analysis that it is composed of a woody fibre, starch, gum, sugar, fat and protein. Again; ask a geologist to examine the soil, and he will designate the different ages to which it belongs and the various rocks from which it is derived, but, without the chemist, he is unable to determine the nature of its constituents, and hence cannot foretell, before any cultivation has been attempted, whether it is destined to be fertile, or of what kind of vegetation it is best able to promote the growth.

The application of chemistry to agriculture is thus naturally indicated; by its aid we obtain from the soil, from plants and from animals, at the lowest possible expenditure of time and money, the highest possible quantity of those substances indispensable to our physical well-being.

Production, in order to be cheap, must be rapid and plentiful, and we all know that the progress of unaided nature is methodical and slow.

Chemistry, by investigating the natural laws which govern the development of all living things, and by carefully observing the facts acquired by the practical experience of centuries, endeavours to provide the farmer with means by which he may assist and hasten the processes of nature. His work is, of course, still far from complete, but it has familiarized us with those elements which are essential to plant growth, taught us how those elements are distributed, shewn us what portion of them is or should be contained in our soils, and what soils are most propitious for different kinds of plants.

When our globe was launched into space, it was a liquid somewhat similar in consistency to molten glass, and, therefore, presented a vastly different appearance to that with which we are acquainted. It was made up of about sixty elementary bodies, so deposited, by order of weight or density, that the heaviest, such as gold, silver, lead and copper, were in the centre, while the lighter, such as calcium, aluminum and silicon, remained, and still exist, near the surface, where they have combined to form clays, limestones and sands.

Encircling its interior was a heavy, poisonous atmosphere, comprising all those elements which at a very high temperature assume the gaseous form—notably sulphurous, sulphuric, phosphoric, hydrochloric, nitric, boric and carbonic acids, with torrents of steam, and dense clouds of mercurial, antimonial, arsenical and other metallic vapors. When this mass began to cool, it probably resembled an immense glass ball the solidified sides of which were uplifted by the bubblings of the intensely hot liquid mass within. These solid projections formed our mountains, and, passing from the transparent to the opaque, they gradually assumed the crystalline form. What is known as the earth's crust must have resulted from an extraordinarily forcible action consequent upon the fall of temperature. The vapors already alluded to were condensed into rain. The rain dissolved all the acid bodies, and these acids, attacking the alkaline crust, combined with its most powerful bases to form various salts. These salts soon underwent decomposition; some—such as sulphate of lime or gypsum—were deposited, while others, principally the chlorides, remained in solution and formed the seas. The neutralization of the stronger and more corrosive acids permitted the weaker carbonic acid to develop its activity, and it is this acid which has continued to play the most important part in nature in our own times. Held in solution by the running waters, it attacked and dissolved the various bases which existed in such large quantities in the mountains, and deposited them in the form of carbonates in the still warm valleys. This process of saturation, or neutralization, being entirely accomplished, chemical equilibrium may be said to have become established; the period of great geological catastrophes, therefore, came to an end, and the temperature of the earth gradually sank below the boiling point. A few volcanic disturbances continued, it is true, to occasionally convulse it; there was the upheaval, splitting asunder and complete overthrow of the most gigantic mountains, the drying up and the division of seas, and the formation of lakes of both fresh and salt water. As the temperature continued to cool, however, these disturbances became more and more rare, and there then commenced that formation of the soil which gave rise to the phenomena of vegetation.

VARIETIES OF SOIL.

It is the general custom to class arable lands according to the nature of their predominating constituents, and thus we allude to soils as sandy, clayey and limey.

Sandy soils are distinguished by their extreme porosity, and are frequently in such a fine state of division, that in the dry season the least wind will displace and scatter them in all directions. In such cases they are naturally sterile; but, when they are sufficiently moist, they facilitate and encourage the growth of an immense variety of plants of the lower order, which, by their eventual decomposition or putrefaction, form considerable

deposits of that valuable substance called humus.

Such soils are more propitious than any others for the development of plants with very delicate or fine roots, such as barley, rye, oats, lucern, lupins, lentils and potatoes; but they require constant attention, and a large and regular quantity of manure, because their porosity permits them to absorb such an abundance of oxygen, that all their organic matter is rapidly burnt up.

Clayey soils are heavy and compact, and, when they contain more than fifty per cent. of pure clay, are onerous to work, and unprofitable to cultivate. It has, however, fortunately been discovered that the addition to them of so small a quantity as two per cent. of burnt lime suffices to so entirely change their nature and consistency, by transforming the silicate of alumina into a porous silicate and aluminate of lime, that it is now an easy matter in districts where lime is cheap and plentiful, to overcome this difficulty. In hot countries or in windy regions or in districts where the sub-soil is of a very permeable character, good clay lands offer great advantages, and although they periodically require the application of large quantities of reconstituents, they possess the faculty of retaining all the precious elements supplied to them, and of storing them up for the use of successive crops. When they contain a proportion of about ten per cent. of carbonate of lime, or chalk, they are the best of all soils for the extensive growth of such important plants as wheat, corn, clover, hemp, peas and beans, and of such trees as the chestnut and the oak.

Limey, or purely calcareous, are even lighter than sandy soils, and when, as is sometimes the case, they are very white and dry, they are absolutely barren. Such as these are, however, easily encountered, for we generally find them mixed with a sufficiency of clay to give them some degree of consistency, and render them available for ordinary purposes. Few soils are entirely devoid of lime, owing to the fact that all rocks contain it in greater or lesser proportion, and because it is transported in immense quantities by waters, in the form of bi-carbonate, and deposited. If it were otherwise, or if, in the absence of lime, other alkaline substances were not forthcoming, the acid principles secreted by all plants could not be saturated, and the inevitable result would be decomposition and death. In its pure form, however, lime is such an extremely strong base, that it is incompatible with life, and hence it is never allowed to exist in the soil, unless it be combined either with carbonic or silicic, or sometimes with sulphuric and nitric acids.

The general properties of every variety of soil are much influenced by colour; those which are white, and hence unable to absorb the solar rays, being invariably cold, whereas those which are dark are warm and fertile. In this regard both iron and manganese are of undisputed

value, for by their transformation into ferric and manganic oxides, they produce the deep red or brown so much admired by sagacious farmers. In damp climates or in very moist soils, however, too much iron is apt to become a source of considerable danger, from the fact that, by the exclusion of air, the ferric is reduced, by its affinity for water, into ferrous oxide, and in that form exercises a highly corrosive action on vegetable life.

ELEMENTS OF PLANT LIFE.

Sixty years ago there was no such thing as what we now call scientific agriculture. In the old countries men were asking themselves the very question that faces us to day—how it is that lands which were once so fertile and productive now show signs of approaching exhaustion. The answer to this question could only be given after we had found how out-door plants live, whence they obtain their food, of what elements that food is composed; how it is conveyed to the plants and how they absorb it into their organisms. In point of fact the manner of life in plants is very similar to the manner of life in animals and man. They require certain foods in stated proportions which pass through the process of digestion; they must breathe a certain atmosphere and they are subject to the influences of heat and cold, light and darkness.

The tissues of their bodies, like ours, are composed of carbon, hydrogen and oxygen, and contain besides nitrogenous principles, certain minerals, such as phosphoric acid, lime, potash, sulphur, magnesia and iron. It will be seen at once that if it is necessary for us to constantly absorb a sufficiency of these self-same elements to keep up our normal heat and provide us with new tissue, it must be no less essential for plants to acquire similar food, for similar purposes.

Pure atmospheric air is a mixture of nitrogen and oxygen, with a small proportion of aqueous vapor, and about 4-10,000th of carbonic acid, while water is formed by the combination of two parts of hydrogen and one part of oxygen. It is therefore apparent that the principal organic elements of plant food exist in the atmosphere as air, water and charcoal, and may be absorbed from without by the leaves, while the whole of the mineral bodies in order to be found in the soil, should be taken up from within by the roots.

How plants absorb and elaborate the inorganic matter necessary to the food of those graminiferæ which afford to man the bulk of his animal sustenance, or what process is undergone in the assimilation of carbon, hydrogen, oxygen, and nitrogen, which, in the form of carbonic acid, water and ammonia, or nitric acid, are taken from the air and the soil, we have no space to discuss; but, it will be interesting to quote a very beautiful and practical illustration of the contrast between them and ourselves, furnished by Dumas.

Vegetables.	Decompose Produce.	Man and Animals.	Consume Produce.
{ Nitrogenous Matter, Fatty Matters, Gum, Sugar, Starch.	{ Carbonic Acid, Water, Ammonia.	{ Nitrogenous Matter, Fatty Matters, Gum, Sugar, Starch.	{ Carbonic Acid, Water, Ammonia.
Evolve oxygen, constitute apparatus of reduction and are stationary.		Absorb, oxygen, constitute apparatus of oxidation and are locomotive.	

The consideration of this remarkable contrast leads us to contemplate the progressive exhaustion of the soil, and the necessity for its reconstitution by the aid of chemistry, for, while admitting that *we produce those very elements* which the plants decompose, and which are so necessary to their existence, it is nevertheless a fact that *we are locomotives, and do not in practice give back to them what we have taken away.*

The elementary composition of plants being thus determined, the next step that suggested itself to investigators was the analysis of the soil, in order that comparisons might be established between virgin lands which had borne no cultivated crops and old soils which had long been tributaries to every kind of vegetable culture.

Briefly stated, it was found that good, ordinary young lands, contain in abundance most of the dominating ingredients discovered in plant organisms, and that soils which have long been under cultivation, and now show themselves incapable of their former remunerating production, only contain these dominants in minute proportions, or lack them altogether.

These data form the basis of our present science, and may be summed up in the following manner:

A. Plants require for their nourishment and prosperity a given quantity of food, composed in varying proportions and according to their different natures, of hydrogen, oxygen, nitrogen and carbon, and of phosphates, sulphates and chlorides.

B. The hydrogen and oxygen, in the form of rain or dew, are supplied as water, and the carbonic acid is mainly derived from the air.

C. Good virgin soils contain the whole of the necessary minerals, in addition to considerable quantities of nitrogenous and carbonaceous matter.

D—Long-cultivated and non-productive soils may be termed exhausted, since chemical analysis *proves their inability to furnish the needful substances in quantities equal to those found in the ashes of healthy plants.*

FERTILIZERS AND AMENDMENTS.

Having arrived at this important stage of progress we understand that, if agriculture is to continue to be the basis of national wealth and prosperity we must find means of restoring to our soils, if not in a natural in some artificial form, the chief elements yearly taken away from it by our crops—we say *chief* elements because

a great number of the necessary minerals are only required in very minute proportions, and therefore generally exist in sufficient abundance. We may consequently disregard all these, and devote our attention to nitrogen, potash, phosphoric acid and lime, since these not only play the most important part in the functions of vegetation but are the most liable to complete exhaustion. The following figures representing averages compiled from the official reports of the United States Department of Agriculture extending over a series of years, will be found very *à propos* for the purpose of illustrating the arguments already put forth.

ELEMENTS OF FERTILITY TAKEN FROM THE SOIL PER ACRE AND PER ANNUM, IN POUNDS.

—	Nitrogen.	Lime.	Phosphoric Acid.	Potash.
Wheat.....	25	15	30	45
Maize.....	55	45	80	40
Oats.....	30	14	18	20
Barley.....	35	12	18	20
Rye.....	25	13	25	35
Buckwheat.....	35	12	40	38
Hay.....	40	40	15	40
Tobacco.....	not calc'd.	160	not calc'd.	340
Turnips.....	do	100	45	150
Potatoes.....	44	60	52	185

These are, of course, only a few examples, but they will suffice for present purposes, and it is perhaps hardly necessary to add that if, according to the nature of the crop desired, at least a sufficient proportion of each of these essential elements be not present in the soil, the plants will languish, various malignant diseases will declare themselves, and death will inevitably ensue before they reach maturity.

Now, the practical question that must naturally arise, is, how may all this loss be repaired, and whence are all the elements needed to repair it to be derived? It is not so very long ago since this question would have been generally answered by the words, "farm-yard manures," and even to-day there are a large majority of farmers who depend exclusively upon this valuable fertilizer.

The fallacy of their policy is, however, made apparent by a simple calculation, which any interested reader can work out for himself, in this wise.

The necessary elements to the growth of a medium crop of hay have been put down, approximately, per acre, as:—

Nitrogen.....	40 pounds.
Lime.....	40 "
Potash.....	40 "
Phosphoric acid.....	15 "

The very best farm-yard manure is found to contain, on an average, for every hundred pounds, exclusive of water and fibre:—

Nitrogen.....	not quite $\frac{1}{2}$ pound.
Lime.....	little more than $\frac{1}{2}$ "
Potash.....	about $\frac{1}{2}$ "
Phosphoric acid.....	(say) $\frac{1}{4}$ "

With a very moderate allowance for loss in storage, drainings, evaporations, etc., it must be conceded from these figures that to repay what has been borrowed from the soil by a single crop of hay would call for some six tons of material per acre; and there is probably only a very limited number of farmers—even if there are any—who could produce anything like this quantity. The practical answer to the question propounded, therefore, is that we must profit by the teachings of science and turn to artificial or chemical fertilizers as the only means of avoiding present loss and eventual poverty. This leads to a brief glance at the most accessible materials, and the forms in which they are most appropriate for the requirements of growing plants.

NITROGEN.

The sources and the supplies of nitrogenous elements, outside the free nitrogen and the ammonia that exist in the atmosphere, are numerous and plentiful. Every species of plant, roots, stalks, leaves and seeds yield it up in varying proportions, under the influence of decay. The refuse or waste from an average crop of clover contains about fifteen pounds of assimilable nitrogen per acre, and some of the other green crops are so rich in this element that it has become customary to occasionally grow them for the express purpose of plowing them under directly they have reached maturity. Outside the farm, we have guano, fish, wool rags, horns, hoofs, hair, blood and all other animal refuse from the slaughter-house, and, failing a sufficiency of all or any of these, there are the nitrates of soda and potash, and sulphate of ammonia.

The following are about the proportions of nitrogen contained in every 100 pounds of some of the foregoing materials:—

100 lbs. shoddy	contain	7 lbs. nitrogen.
100 " wool dust	"	9½ "
100 " dried blood	"	12 "
100 " rope cake	"	5 "
100 " cotton	"	5½ "
100 " sugar scum	"	3 "
100 " leather cuttings	"	8 "
100 " sul. ammonia	"	21¼ "
100 " nitrate of potash	"	13¾ "
100 " " soda	"	16½ "

POTASH.

We have seen that the quantity of potash absorbed by the most important of our crops is greatly in excess of phosphoric acid. It may consequently be assumed that continued fertility depends upon a preponderance of this important base. This, nature has in a great measure provided for, by promoting the continuous decomposition of feldspathic and other rocks, and by favouring the transfer of potash in the various forms of silicates, carbonates, and oxides from the subsoil to the surface.

When all these varieties fail, however, it is easy to secure inexhaustible supplies from the nitrates and chlorides, which are either deposited in various localities on the surface, or in the interior of the earth's crust, or held in solution by the waters of the sea.

Potash salts, to be readily assimilable, or

useful to the plant, must be liable when introduced into its sap, to so easy a decomposition, that their liberated alkali may enter at once into the necessary combination with the organic compounds.

If, as it is applied, the potash be united to its acid by too strong a bond, the vegetable will be unable to effect a dissociation; and the salts will accumulate in the tissues, and become a mere burden instead of promoting healthy growth.

This question of assimilation, therefore, is one that demands very attentive study; and it is from the data collected by the most recent scientific discoveries in relation to the laws and powers of affinity, that the various salts, according to their adaptability, have been classed in the following order:

Carbonate,	Sulphate,
Nitrate,	Chlorides.

The amount of potash contained, in round figures, in each of these salts when pure is as follows:

100 pounds Carbonate contains 68 pounds of potash.

100 pounds Nitrate contains 46½ pounds of potash.

100 pounds Sulphate contains 54 pounds of potash.

With regard to the chlorides, which are compounds of chlorine and *potassium*, it is necessary before they can furnish anything available that they should undergo a preliminary decomposition in the soil, but it may be assumed that when this has taken place, every 100 pounds of the pure chloride would be equal to about 63 pounds of potash.

On the assumption that neither the sulphate of potash, nor the chloride of potassium is directly assimilable by plants, their efficacy must depend upon the composition of the soil under treatment, and the character of any other fertilizers with which they are simultaneously used.

To illustrate this it is only necessary to imagine a mixed fertilizer containing in suitable proportions, superphosphate of lime, sulphate of ammonia, and muriate of potash.

As soon as this compound reaches the soil, a reaction is commenced between the whole of the salts, resulting in the production of phosphates of ammonium and potassium, and sulphate and chloride of calcium.

The two latter will be washed down into the subsoil by the rains and carried away, while the two first will enter the roots, and be very readily decomposed in the sap, and utilized by the plant.

If, instead of the above, a mixture be chosen of nitrate of soda, and either the muriate or the sulphate of potash, a similar transformation will take place; chloride or sulphate of sodium being produced on the one hand, and nitrate of potash on the other.

Dispensing with unnecessary reiteration, these typical examples sufficiently illustrate the importance and advisability of making preliminary

trials upon a small scale, with each salt, in every case where the use of potash has been determined upon, since, under the varying influences of the different elements in every soil, uncertain and unlooked-for results may be obtained.

PHOSPHORIC ACID.

This indispensable fertilizing agent is probably the one in which all cultivated soils are most deficient, and, to make matters still more complicated, its occurrence though so plentiful in nature, is found to be most unequal.

It does not exist in the atmosphere; soils of the granitic and tertiary formations are nearly deprived of it; and many other species only contain it in very slight traces.

The following are the principal and most available commercial sources of phosphates for agricultural purposes, viz.:

First, Natural phosphates, of animal or mineral origin, such as bones, bone-ash, and apatites very finely ground.

Second, Superphosphates, manufactured by treating these raw materials with a sufficient quantity of sulphuric acid to transform them from an insoluble into a soluble form.

Third, Precipitated phosphates, obtained by dissolving raw phosphates in hydrochloric instead of sulphuric acid, and adding to the liquid a milk of lime.

From which of these forms the most direct advantage is to be obtained by the farmer, is a somewhat disputed question. Accepting the generally admitted and rational theory, that no element can penetrate into the interior of a plant unless it be in the form of solution, it naturally follows that preference will be invariably given to those commercial phosphates which are most readily subject to dissociation; and this will entirely depend upon two conditions:

(a) Their own degree of aggregation.

(b) The nature and composition of the soil in which they are employed.

The first thing to be obtained is undoubtedly a fineness of pulverization, which will so divide the molecules as to render them easily decomposable by the natural action of the elements contained in the ground, and in this only partial success has been achieved by mechanical means. So long ago as 1851, Leibig recognized the difficulty, and proposed, in order to solve it, to chemically perform this operation by manufacturing superphosphates.

From the standpoint of disintegration, this method has been entirely satisfactory, and has enabled agriculture to rapidly obtain results from the use of phosphoric acid, which would otherwise have been impossible. From a chemical point of view, however, the whole theory fails. We know that superphosphates are only soluble in water so long as the sulphuric acid with which they have been manufactured retains its ascendancy over the lime, and that when they reach the soil, especially where carbonates are in abundance, the sulphuric acid is at once overpowered. The phosphoric acid, being

unable to exist in a free state is taken up by the lime and iron and at once reverted to a tribasic form. In other words the whole question is one of time, and of dollars and cents.

The farmer buys a ton of raw phosphatic material finely ground, and containing say twenty-five per cent of phosphoric acid for \$10. If his land contains neither humus nor acid elements, nor a sufficiency of lime, the phosphate will not decompose and he will have to wait perhaps several years before obtaining any appreciable results for his outlay. On the other hand he buys a ton of superphosphates, containing only fourteen per cent. of phosphoric acid for \$20 and applying it to an exhausted soil, producing the desired results on his very next crop. Hence it is apparent that the phosphoric acid of the latter is more assimilable than that of the former case; and this assimilability can only be due to the absolute state of division insured by the series of decompositions to which the raw phosphate is exposed during the manufacturing process. To define with scientific accuracy the exact merit or intrinsic value of any specific phosphate, is a matter of very serious difficulty; since, besides that of its own physical conditions, so much depends upon the nature and composition of the soil in which it is to be employed. No better examples of this truth could possibly be found than the preliminary comparative experiments, conducted during the past two years, with raw basic slag, and various other phosphatic materials; for they have so far proved, that whereas, in some soils the effects produced by crude phosphates fairly rival those obtained with superphosphates, in other soils they are either quite inert or insignificant in their action.

LIME.

All farmers are familiar with the use of lime, but it is doubtful whether many of them know the exact reasons for its application or clearly understand its influence. It may therefore be broadly premised that the objects for which it is employed are two in number.

First. To exercise a chemical action upon the numerous constituents of the soil, and thereby produce a complete modification of its physical and chemical properties.

Second. To furnish it with the quality required by plants for their alimentation and growth. From the figures already given it will occur to the reflective mind that, regarded as a plant food, lime is of less direct importance from a commercial standpoint than either nitrogen, potash or phosphoric acid.

Placing the total quantity yearly removed by crops at an average of 50 pounds per acre a soil need only contain say, half of one per cent. to supply all that could be demanded of it during several hundred years.

Its true agricultural value must consequently be attributed to its qualities as an amendment rather than a fertilizer.

The term "amendment" has been given to substances which, when they are applied to a

soil, effect a change in its general constitution, and thus lime, when mixed into strong, stiff and unworkable soil

a ten to fifteen tons to the acre induces in them a far-reaching chemical decomposition, which, in addition to partially transforming them into the more porous silicates and aluminates of lime, sets free large quantities of alkaline salts that were previously unable to co-operate in the phenomena of vegetation because bound up in insoluble combinations.

This marvellous effect would of itself create for lime a very high place in the estimation of farmers; but it by no means represents the total scope of its usefulness, as will be clear to those who recall its properties as a generator and promotor of combustion. The accumulation of vegetable remains in various stages of decay and putrefaction, left in the ground by the crops or intentionally plowed under for the purpose, results in the production of a body known as humus. If left to itself this body would so acidify the soil as to destroy its normal basic or alkaline reaction. It could consequently no longer afford nourishment to any of those plants which generate the elements of animal food. In order to successfully cultivate such lands it is therefore necessary to neutralize their acidity; render them alkaline, and remove the excess of these organic matters.

All these conditions are perfectly fulfilled by burnt lime. The word "combustion" designates that process by which an organic body principally composed of carbon and hydrogen, with traces of nitrogen, unites with the oxygen of the air to form oxides. Thus, coal, coke, wood and vegetable refuse, although burnt to create heat, and apparently thereby destroyed, in reality merely undergo a chemical change, arising out of that scheme of nature which has provided for the restoration of all their constituents to the atmosphere and the soil.

The carbon continues with the oxygen of the air to form carbonic acid gas; the hydrogen and nitrogen, momentarily set free by this action, unite themselves together to form ammonia; while the ash consists of oxidized mineral matters.

With the exception of fluorine, every element combines with oxygen to form oxides, and in doing so develops more or less heat. The warmth of the animal body is created and sustained by the oxidation of the starchy or fatty or carbonaceous elements of food; and, hence, while animals breathe in oxygen, they breathe out carbonic acid, gas and steam. When this natural chemical process is stopped, the animal dies; or, to speak more forcibly, when no more food is provided, or no more oxygen inhaled, the internal fire ceases to burn, and everything grows cold.

This is but a brief definition of combustion. It, however, suffices to establish that oxygen is the promoter of the phenomenon, and hence to explain that, if great masses of decaying humiferous matters sometimes linger in soils, it is

because the latter are cold and wet and have become so choked up and cohesive as to preclude a proper circulation of air.

Oxygen is thus unable to reach them until they have been warmed, dried and made porous. Burnt lime, when properly administered, accomplishes all these objects.

By its great affinity for water and the intense heat of its combination, all moisture is absorbed. The rapidly drying soil cracks and opens up in every direction, and free ingress being thus afforded to the air, a vigorous and permanent combustion sets in.

Attacked in its turn by the carbonic acid gas resulting from the combustion process, it is converted into carbonate of lime, and, alkalinity being thus gradually restored, the plough completes the conquest, and barren wildernesses become fertile plains.

Reviewing these effects and briefly summing up its advantages, it will be seen that, independently of its power to impart porosity and to facilitate combustion, lime sets free various alkaline salts from useless combinations, and renders them available as plant-food. It also decomposes certain injurious salts of iron, magnesium and manganese, counteracts the evil influences of all kinds of sulphurous emanations, and, before being transformed into carbonate, destroys, by its causticity, vast quantities of ravaging insects and their eggs.

Despite these great advantages, it must be noted that the indiscriminate use of this powerful oxidizing agent on good ordinary cultivated soils would be productive of disaster.

Lest this statement be regarded as conflicting, it is explained that a good soil is what has been described as a mixture containing all the elements required for plant-food, in a proper physical condition, and with a due proportion of humus or organic matter. This humus is of the utmost importance.

First. Because, by its very slow oxidation or combustion it helps to maintain the warmth of the soil.

Second. Because it contains a considerable quantity of nitrogen, which is gradually transformed by this slow combustion into ammonia or nitric acid and nitrates.

Third. Because it has the invaluable property of always retaining moisture, and thus can enable plants to withstand periods of drought which would otherwise kill them.

However rich it may otherwise be, it has been demonstrated, by experiment, that no soil is perfect which contains less than two per cent. of humiferous matter.

This is why scientists untiringly urge upon farmers to provide for its maintenance by using in addition to artificial fertilizers all the farmyard manure they can scrape together and to carefully plough under, instead of burning, as they are so prone to do, all the refuse from their crops.

The imperative necessity of this duty is intimately connected with the most complicated

ESTABLISHED 1858.

THE
Morrisburg Implement Works

Patented Dec. 17th, 1885.



Patented Dec. 17th, 1885.

THE "NEW MODEL" ROTARY DISC
JOINTED PULVERIZING HARROW.

Effective in Work, Simple in Construction,
Durable in Wear, Convenient in Handling.

Progressive farmers say that it is the very best farm
implement ever produced.

We specially request every one who contemplates purchasing a Harrow of any kind to test and compare the working of these harrows by the side of any harrow or Cultivator on the market. It will pay you to do so. See one, try one, buy one and be happy.



THE "SPEED"

ROOT AND PUMPKIN CUTTER

(Patented February 2nd, 1887.)

The Simplest, Fastest Cutting and Easiest
Running Cutter in the Market.

We have pleasure in drawing your attention to this new principle in a Root Cutter. This cutter has ten knives attached to a cylinder set diagonally, each acting independently of the others; thus every revolution of the cylinder cuts ten slices, giving a very fast cutter with very little power required. One man can easily cut 1½ bushels of roots per minute. We are making all cutters with pulley so they can be run either by belt or hand. We make this cutter with either 12, 15 or 18 inch knives.



THE WARRIOR MOWER.

The great many years it has been in successful use in the field has proved it to be superior in mechanical construction, lightness of draft, ease of management, durability and capacity to do good work under all circumstances. Write for circulars and testimonials from leading farmers. Agents wanted in all sections not already occupied. Address J. F. Millar & Son, Lock Box 35, Morrisburg, Ont.

THE STIRLING

High Pressure Boiler

MANUFACTURED BY THE

Dominion Safety Boiler Co.,

(LIMITED),

31 Wellington Street,

MONTREAL.

The Safest, Most Durable, and most Economical
Boiler yet Invented.

The large incandescent fire brick furnace causes perfect combustion of any kind of fuel, hard coal, soft coal, slack coal, cordwood or sawdust. The large mud drum collects all the impurities from the water. Made entirely of best wrought metal, no cast iron used. There can be no unequal expansion, as the mud-drum falls and rises as the tubes expand and contract. The removal of three manhole covers gives easy access to every part of the interior of the drums, and to both ends of every tube.

Dry Steam guaranteed.



A PERFECT FOOD

This statement is made upon the results of scientific analyses by the best chemists in the world. FRANCIS WYATT, Ph. D., Analytical Chemist, New York, after giving an exhaustive analysis, says:—"Here we have the whole of the elements, without a single exception, necessary for the formation of flesh, muscle and bone."

JOHNSTON'S FLUID BEEF

Is not a mere meat extract or a concentrated decoction, but simply fluid beef, containing, besides the albuminoids and gelatinoids, the correct proportion of those phosphates so essential to the support of life.

F. W. MASON,
PIANO TUNER,
REPAIRER AND REGULATOR.
Ottawa and surrounding Villages.

Address

Cumming's Bridge, Ottawa, Ont

Dominion of Canada



FREE FARMS FOR MILLIONS

200,000,000 Acres

Wheat and Grazing Lands, for Settlement, in

MANITOBA AND CANADIAN NORTH-WEST.

Deep soil, well watered, wooded and richest in the world—easily reached by railways. Wheat—average 30 bushels to the acre, with fair farming.

The Great Fertile Belt

Red River Valley, Saskatchewan Valley, Peace River Valley, and the Great Fertile Plains, Vast Arcas, suitable for Grains and the Grasses, largest (yet unoccupied) in the world.

VAST MINERAL RICHES—GOLD, SILVER,
IRON, COPPER, SALT, PETRO-
LEUM, Etc., Etc.

IMMENSE COAL FIELDS—ILLIMITABLE
SUPPLY OF CHEAP FUEL.

Railway from Ocean to Ocean!

ROUTE—Including the great Canadian Pacific Railway, the Grand Trunk Railway, and the Intercolonial Railway, making continuous steel-rail connection from the Atlantic to the Pacific Ocean through the great Fertile Belt of North America and the magnificently beautiful scenery of the North of Lake Superior and the Rocky Mountains.

New Route from England to Asia, wholly through British territory, and Shortest Line through America to China, Japan, Australia and the East. Always sure and always open.

Climate the Healthiest in the World.

The Canadian Government gives Free Farms of 160 acres to every male adult of 18 years, and to every female, who is head of a family, on condition of living on it, offering independence for life to every one with very little means, but having sufficient energy to settle.

Further and full information, in pamphlets and maps, given free on application by letter, post free, addressed to Department of Agriculture, Ottawa, Canada, or to High Commissioner for Canada, 9 Victoria Chambers, London, S. W., England, and all Emigration Agents.

Ottawa, September 2nd, 1889.

JAMES S. NOAD, MINING ACENT

AND PROMOTER OF AND DEALER IN

Mines and Mining Properties,
MONTREAL, CANADA.

MINES AND MINING PROPERTIES.

The undersigned, representing a London Syndicate, is prepared to negotiate for desirable Mines and Mining Properties, for the purpose of forming them into Joint Stock Companies, or providing cash capital for their proper development.

Address or call on

JAMES S. NOAD,
Montreal.

JAMES S. NOAD, MINING ACENT

AND PROMOTER OF AND DEALER IN

Mines and Mining Properties,
MONTREAL, CANADA.



DODGE PATENT

Wood Separable Split Pulleys

Best Belt Surface, Lightest, Strongest, Best Balanced and Most Convenient Pulley in the World.

WITH OUR PATENT BUSHING SYSTEM

In Comparing Prices of Pulleys please note carefully the following:

1. Our list is lower than most others.
2. Every Pulley is a Split Pulley.
3. Every Pulley is guaranteed to transmit from 25 to 60 per cent. more power than an iron one with same tension of belt.
4. Our Pulleys are 70 per cent. lighter than iron pulleys.
5. The fastening does not mar the shaft.
6. They are perfect in Balance.
7. They can be used on many different sizes of shafting.
8. They are the most thoroughly made wooden pulleys in the world.
9. And the handsomest pulley on the shaft.
10. No chances to take. Every pulley as represented or no sale.

Order a Sample Pulley, after which you will have no other.



EVERY PULLEY IS A SPLIT PULLEY
Made in any size from 9 inches to 16 ft. diameter
with original bores of 3 and 3½ inches,
bushings to be used for intermediate sizes;
larger ones bored to order.

WE ALSO MANUFACTURE
WOODEN GROOVED PULLEYS FOR THE TRANSMISSION OF POWER
BY MANILLA ROPE,

Under the Dodge Patent System from 5 to 500 h. p. State power to be transmitted, speed of shafts, relative position of shafts, distance between shafts, and we can furnish a clear estimate.

EVERY PULLEY WILL FIT.
22 or more sizes of Shafting.
200 of our Pulleys and an assortment of bushings represent as many as 4,000 iron pulleys, a great advantage to dealers carrying stock.

Apply for particulars to THE DODGE WOOD SPLIT PULLEY CO., TORONTO.



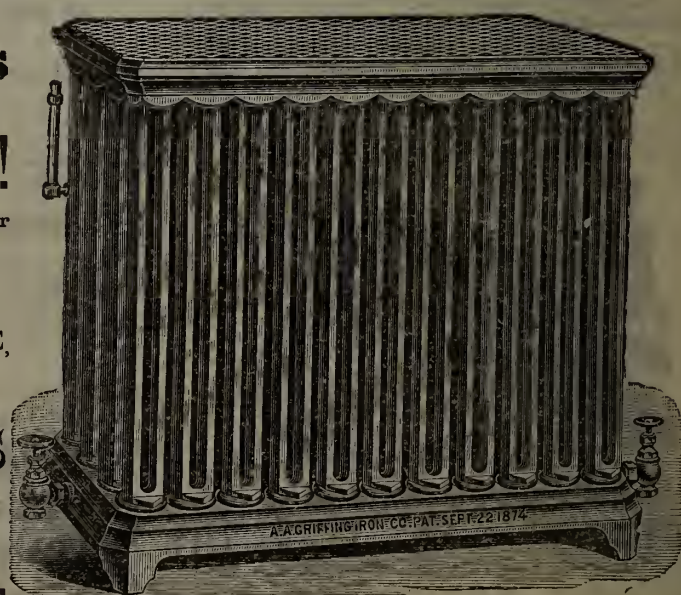
USE GURNEY'S IMPROVED CELEBRATED Hot Water Heaters!

Guaranteed more Economical than any other
Heater now made, and containing every
known Improvement in Hot
Water Heating.

STEAM FITTINGS, CAST IRON PIPE,
REGISTER, GRATES, ETC.

HOT AIR FURNACES
FOR COAL OR WOOD.

E. & C. GURNEY & CO.,
MONTREAL.



Bundy Radiators for Quick Circulation and Economy of Space.

problem yet remaining to be solved by agriculturalists, (i.e.) whence to obtain sufficient assimilable nitrogen to integrally replace what is taken from the soil by the crops, and exported with them to foreign countries every year, without having recourse to any of the costly commercial substances already enumerated.

The pet theory—so beautiful as a theory—of obtaining it directly from the air, in a suitable form, and at a fabulously cheap price, continues to occupy many clever brains in many scientific laboratories, but is still as far as ever from a practical solution; on the other hand since it has been proved that nitrification chiefly results from the extremely slow oxidation of organic matter in alkaline soils, it naturally follows that so long as there exists a sufficiency of humus under favourable conditions, no dearth of available nitrogenous plant food need be apprehended.

Unfortunately, the immense amount of exportation, combined with misconceived notions of sanitation, prohibit all hope of restoring to the lands the whole of the required nitrogen in an organic form. It is consequently all the more necessary to manipulate what remains in a spirit of economy; to handle the soil with delicacy, care and intelligence, and above all things, to avoid introducing into them any substance which may interfere with their normal, regular, and natural functions.

The Application of Ground Phosphates.

Prof. Arthur R. Guerard.

With the appearance of Liebig's book, "Chemistry in its applications to Agriculture and Physiology" (1840), may be said to have begun a new era in the art of culture. To Liebig we are indebted for the right understanding of exhaustion and restoration in agriculture, the neglect of which had converted many once fruitful districts into hopeless deserts. It was Liebig who pointed out that the inorganic elements of plant-food in the soil were the most important, the easiest exhausted, and that their constant removal in the harvest was, notwithstanding the rotation of crops, and the then usual system of manuring, a robbery of the soil, which enriched the present at the expense of the future. This was the so-called "mineral" theory, to which was opposed the "nitrogen" theory, giving the chief value in the nourishments of plants to the organic substances, the nitrogen products. In the controversy which ensued, the results obtained under Liebig's system at the numerous experimental stations and confirmed in general farm practice eventually drove the nitrogen theorists out of the field. The restoration to the soil, upon scientific principles, of the constituents taken from it thus founded a new and increasing industry, the manufacture of commercial fertilizers, in which the opening up of extensive deposits of potash, salts, and phosphate of lime took an important part. Justus Von Liebig may, therefore be rightly called the founder of the high art of culture.

But in acknowledging all that is due to this illustrious chemist, and admitting that his views were generally correct, it cannot be denied that he was sometimes more suggestive than conclu-

sive, while his principles, having unfortunately been accepted on faith, have led, in some instances at least, to false conclusions. Remarkably has this been the case with the application of vitriolated or superphosphate of lime, the manufacture and employment of which have now assumed such vast proportions, that it is fitting some investigations were made into the principles which govern its use. But before entering into this subject perhaps it may be well, for the sake of clearness, to give some general idea of the food requirements of plants and the nature of manure, in which I crave indulgence of those whom I may take over old ground.

Plants require for their complete development organic and inorganic elements, of which they consist. One part of these is afforded by the atmosphere, the other by the soil. The latter are left as ashes on burning, while the former go off in gaseous form. The inorganic, incombustible elements are: potash, soda, lime, magnesia, phosphoric acid, sulphuric acid, and iron; the organic, volatile elements are carbon and nitrogen. Plants receive carbon in the form of carbonic acid and nitrogen in the form of nitric acid and ammonia; these last being furnished directly or indirectly from the atmosphere, while the soil must contain all the necessary mineral constituents in a proper physical condition for plants to grow and thrive upon it. The fundamental conditions, therefore, for plant production are given in the air and soil.

The circumbient air is the mediator of heat from the sun, climate being the first factor in plant growth. The other no less important factor, is the soil. Soil is formed from the disintegration of the rock masses in the earth's crust in various ways, by the action of the air and meteorological appearances—weathering; by the force of water and ice, and finally by volcanic causes, as they are still active in some countries. In general, the formation of soil is not to be considered as complete, but on the contrary as continuing unceasingly and evident everywhere. The soil for the most part consists of inorganic with a small proportion of organic constituents, such as vegetable and animal remains. Formerly these last, so called *humus* were considered to be the active agents in the nourishment of plants and a soil was valued according to the quantity of *humus* it contained. But this view has been abandoned. We now know that the inorganic elements in the soil are the essentials of plant food.

All kinds of soil contain a certain number of chemical bodies, which may be considered as constant parts in soil, such as silica, alumina, lime, magnesia, potash, soda, iron, and partly combined with these, carbonic acid, phosphoric acid, sulphuric acid and ammonia; finally water, which occurs both in chemical as well as mechanical combination. Besides these we find other chemical bodies in soil, but in smaller quantity and without special importance for vegetation. But it is only with the upper layer of soil and under certain conditions with the sub-soil that the agriculturist is concerned.

This vegetable layer contains a certain amount of plant food, which, by the continued removal in the harvest, is gradually but entirely extracted. It is for this reason, therefore, in order to keep up the productive power of arable soil, that the renewal of such substances as serve the purpose, and which the harvest has removed, is necessary. This restoration is manuring. Now, when a plant is burnt, a great portion of its elements passes off in gaseous form, while a part remains as ashes. The most important ash elements are lime, potash and phosphoric acid; volatile elements, carbonic acid and ammonia. The soil

must contain, or be able to develop, all these to be fruitful. Not every plant, however, demands one and the same quantity of nourishment; one requires more potash, another more lime, a third more phosphoric acid, but all plants need a portion of all of these elements together, and if one of them only is wanting the plant cannot thrive. Thus, it may be that so great a quantity of the most of these nutritive elements is present in a soil that a continued cultivation is not able to exhaust it; but of others, on the other hand, particularly phosphoric acid and potash, the quantity may be so small that it may well be consumed by repeated harvests. At the same time it is necessary that the manurial plant food should be present in such a form in the soil that it is accessible to the plant; that is, not only in chemical, but in suitable physical combination. Thus, in supplying the nutritive elements of plants in the form most favorable for absorption and assimilation consists the whole art of manuring.

As a matter of course, the restoration must be made in such a manner that the results warrant the outlay; in other words the object is to return to the soil as manure, in the form of worthless or cheap material, these elements which, in the form of valuable, saleable, or useful materials, have been taken away in harvest. The experience of 2,000 years has taught that this restoration cannot be better made than in animal and human excrements. Especially is this the case with stable manure, in which such excrements are mixed with straw, which has generally fulfilled the demands so completely that no substitute of like value has as yet been discovered. It contains the mineral elements of plant food in a condition most favorable for this absorption and assimilation by the plant; the fermentation which takes place in the soil is the fountain of ammonia and carbonic acid, which serve not only as food in themselves, but assist in decomposing other elements found in the soil. By means of this decomposition, accompanied by the generation of gas, heat is produced, and also a favorable mechanical condition of the particles of soil. Yet, nevertheless, stable manure, together with its liquid portion, does not return to the soil in sufficient quantity all the nutritive elements which have been extracted from it, as long as its production is confined to the farm-yard, and not supported from without. Moreover, stable manure does not always contain the two most important inorganic elements of plant food, phosphoric acid and potash, in the right relation for plant production. Upon these grounds the increasing cultivation of the soil and the needs of mankind demand the employment of artificial fertilizers along with, or as a substitute for, farm-yard manure. The important plant food elements act always together; that is to say, each one helps toward the increased power of assimilation of the other by the plant; so that by the employment of one, and one only, by no means will the effect produced upon the plant be in proportion to the quantity of this element used. For example, if a potash fertilizer be used on a soil poor in potash the plants growing on that soil would take up not only a greater percentage of potash, but they would also take up all the other elements in proportion to the addition of potash. The harvest, therefore, from a soil to which potash had thus been added extracts more of the necessary nutritive elements altogether than a harvest from a soil to which no potash at all had been added would do. If, then, a field, and the plant life on it, be always supplied with one and the same food element all the others, consequently, by the help of its

action, would be gradually consumed and the field become unfruitful; that is, it would no more possess all the mineral substances out of which the plant body is built up. This condition lasts until efficient manuring or a renewed decomposition of some undecomposed mineral by the action of the atmosphere furnishes a sufficient quantity of available plant food. But it is not possible in all kinds of soil, by this last means alone, that is, by letting the land rest or fallow, to effect a restoration. Many elements, as phosphoric acid and potash, may be so entirely absorbed out of the soil that a natural restoration is not to be thought off at least only after an indefinite period. This is the cause to which the desolation and barrenness of so many regions is to be attributed, and not to imaginary climate changes or decrease of population. The careless indifference to the relation between exhaustion and restoration may, therefore, be well called a robbery of the soil; for here the present lives on the capital which a long past has heaped up in the soil, but which without or within sufficient restoration must, in a short time, be entirely consumed. To prevent this in a judicious manner, to keep the land ever in a uniform condition of fertility, and to win from it a satisfactory interest, is the duty of the agriculturist. He can only solve this problem in a cultivated land by a rational and scientific system of manuring. Turning now to the main subject of my essay, if any of the delicate membranous parts of plants—the leaves, the stems, the roots—be examined under the microscope they will be found to consist of innumerable small hollow spaces, called cells. These cells are inclosed by a thin skin or membrane, and contain a fluid giving an acid reaction. This is a well-known fact; but it may be easily proved by pressing the root-fibres of any fresh young plant on a bit of blue litmus paper. The paper will be reddened, owing to the disengagement of malic, acetic, citric, or other vegetable acid. Now, by the laws of chemical affinity, this acid demands and combines with a base.

Hence when any of the necessary nutritive elements of plants, as phosphate of lime, in a sufficiently fine state of division, are brought into contact with the cells of the root, the acid in the cells will strive to overcome the obstacle presented by the inclosing membrane, and unite with the base. And this can be visibly demonstrated; for if a glass vessel be filled with the juices of the plant or, which is the same thing, with distilled water containing acetic or other vegetable acid, and a bladder tied over it in such a manner that it touches the liquid, and then a little finely powdered phosphate of lime placed upon it, in the course of a short time the powder will be seen to have disappeared in solution through the pores of the membrane. But if this can be shown in the laboratory, how much more powerful must be the action of the living plant in nature when such powder is brought into contact with the membrane of the cells of the root in search for food! Consider the powerful ramifications of roots sending out their fibres and hairs in every direction, encompassing the soil, penetrating often several feet into the ground; conceive the countless myriads of these living, plant-feeding organs, which must be in contact with the particles of soil in a proper physical condition, and we have an idea of the enormous forces which are here at work.

Admitting then, that the roots of plants have the power of extracting their food immediately from those portions of the soil which are in direct contact with their absorbent surfaces, that is, when the necessary nutritive elements

are present in suitable physical combination, I maintain that the assumption originated by Liebig, that it was only from a watery solution in the soil that mineral plant-food could be assimilated, that in order to be available it must be soluble in water—this assumption, I say, is entirely ungrounded. And yet this is the view which has been almost universally accepted by agricultural chemists. Thus in the manufacture of superphosphates of lime from mineral phosphates, at the suggestion of laws, the object was to render the neutral or insoluble phosphate, by the action of sulphuric acid, soluble in water. Thus the commercial and manurial value of phosphate manures has been estimated by the amount of phosphate of lime present which is soluble in water, that portion which has become reduced or reverted (that is, which has lost its solubility in water), and that which has remained insoluble being considered nearly if not absolutely useless as a fertilizer. Nay some have assumed such authority on the subject, that they have even caused laws to be enacted to prevent the sale of phosphate manures containing less than a certain percentage of soluble phosphate. Assuredly it is time to take up the matter in the interest of the public; for if it is true that finely-ground unvitriolated phosphate of lime is equal in manurial effect to superphosphate, why then should the farmer buy acid to perform a function for which nature has already amply provided? Why should we pay two prices for our phosphate manures, not only in manufacture for so much vitrol which we do not want, and indeed would rather be without, but also in transportation for two tons to get one tone of useful material?

I hold that the insoluble, non-crystalline mineral phosphates (such as Canadian phosphate), as found abundantly in nature, need only to be mixed in fine powder with the soil under suitable conditions. The plant, then, assisted by the action of the weather, will convert with acid from nature's own acid chambers as much of the insoluble into soluble or superphosphate as it requires.

These views have been held by the late Dr. St. Julien Ravenel, of Charleston, since shortly after the discovery of the South Carolina Phosphate deposits in 1867, but although circulated to some extent among his personal friends they did not come before the public until 1877, when the Agricultural Society of South Carolina, struck by their originality and force, appointed a committee to investigate the subject.

The special reasons which prompted the society were the impoverished condition of the low country of South Carolina after the war, the small crops which were made from exhausted land, and the necessity of home production. A series of field experiments were thus instituted under Dr. Ravenel's supervision to test the practical value of his views as applied to the production of cereals and grass, with the object of ascertaining if these crops could be grown at a moderate cost on the poor coast land of the State.

Dr. Ravenel was led to the belief that this could be accomplished by the following considerations expressed forcibly in his own words:

"1. When a sheaf of wheat weighing one hundred ounces is carefully burned, ninety-five ounces disappear; five ounces remain as ashes. The gaseous matter gone off consists of the elements of air and water; the ashes left of mineral matter existing in small quantity in all soil. Ninety-five per cent then of the material which plants are composed is superabundant, while the five per cent. of mineral matter needed is

cheaper in Charleston than anywhere on the globe. Heat and sunlight supply the force by which the germ or seed works this material into the mature plant. Our geographical position secures us an ample rainfall, equally distributed through all the months of the year; bright sunlight, a winter temperature high enough for the growth of important crops, a summer heat not too great for the full development of semi-tropical plants, secure us, in effect, two seed times and two harvests in one year.

"2. As among animals some feed on grass and others require more highly organized matter for their nourishment, so among plants some form their substance from the air, water and mineral matter of the soil directly, while others cannot do so, but live upon the remains of a vegetation which has previously flourished and decayed upon the land. For example, a sheep confined to a good pasture thrives; a dog under the same circumstances starves. The grass must be converted into matter before it can support the dog.

"Wheat will not grow upon poor land supplied merely with mineral matter, but pea-vines will, and when these have decayed upon the land wheat will flourish there. Here the leguminous* plant does for the graminaceous one what the herbivorous animal does for the carnivorous.

We have many leguminous plants, some of which grow from spring to fall, others from fall to spring. By supplying the necessary mineral matter and using those plants which grow during the summer to prepare food for small grain, and those that grow during the winter to do the same for grass, there is good reason to hope that the coast lands may be made to produce remunerative crops, and those of a kind which are sowed and reaped by the efficient labor-saving machines of the day." In order to test the system thus proposed several experimental stations were formed in the neighborhood of Charleston. They were placed under the direction of practical men and conducted with scientific accuracy, reports being made by the committee on coast lands to the Agricultural Society of South Carolina. These reports show an average yield, from a series of years, of twenty-five bushels of wheat, forty-five bushels of oats and four tons of good hay to the acre. The lands on which these results were obtained consisted of poor sandy loam, so exhausted previously that without manure they could not produce eight bushels of oats or five bushels of corn to the acre.

For those who are interested in details I subjoin the following report of results for season of 1878, and give the manner of conducting the experiments:

OATS.			WHEAT.		
No. OF ACRES.	AM'T. Bush.	PER ACRE. Bush.	No. OF ACRES.	AM'T. Bu. Lbs	PER ACRE. Bu. Lbs
(a) $3\frac{1}{2}$	130	40	(d) $\frac{1}{4}$	7 43	30 52
(b) $1\frac{3}{4}$	78 $\frac{1}{4}$	45	(e) $\frac{1}{4}$	6 27	25 48
(c) 1	60	60	(f) $\frac{1}{4}$	5 26	21 44

These six fields were planted under Dr. Ravenel's system, no other manure being used, and all treated in the same manner, except that fields c and d were planted with the drill.

* There are many members of the family of plants called legumes (leguminosae), which may be used as fallow crops, that is, by not extracting the alkalies of the soil, and only a small quantity of phosphates, they exercise no injurious influence on crops which are cultivated immediately after them. They act also as carriers of nitrogen. Such plants are beans, peas, vetch, clover, lucern, buckwheat, &c.

The following is the formula for cultivating cereals and grass as practiced at the experimental farms:

GRASS TO MAKE A MEADOW.

"1. *The kind of grass.*—The Bermuda* (as being particularly suited to that coast) is recommended. It is best to select for a meadow-land well-set in this grass, because it does not seed, and is propagated only by transplanting.

"2. *The manner of cultivating grass.*—Plough the land thoroughly in the spring or early summer, next scatter together broadcast over it two bushels of cow-peas and 500 pounds of ash element to the acre, with seed of the vetch, if the vetch is not already on the land, and harrow and roll it until it is even and smooth enough for the mower.

The peas must not be used as food for man or beast. Suffer them to die on the land in the fall; it is believed unnecessary to turn them in.† The vetch comes up in December, lives through the winter, and dies in the spring and early summer. Then the grass shoots and must be cut from time to time in the course of the summer, when ripe for the mower. The meadow is then established.

"3. *The Manner of Maintaining the Fertility of the Meadow.*—This is managed through means of the ash element and vetch. Every autumn, when the grass has died down, scatter over the meadow 500 to 1,000 pounds of ash element per acre, the quantity being determined by the weight of hay taken from the land; if under four tons, 500 pounds will be sufficient. The vetch having soded itself, as it always does, appears again spontaneously in December, and the two, ash element and the vetch, combine to fertilize the land for the crops of the following summer.

"4. Experience thus far at these farms indicates that the meadow, when so established, must not again be touched with the plow.

THE SMALL GRAINS.

"The land is to be prepared for small grain through a crop of cow peas ‡ as for grass. Having been thoroughly ploughed two bushels of peas and 500 pounds of ash element are sowed broadcast per acre, and harrowed in with a heavy harrow. If, when the peas have matured, there is time to allow them to die on the land, it is more economical, and just as well in other respects that they should. In this case plough the land and sow the grain. But if there is not time the vines must be turned in with a heavy plough and the land harrowed for the grain. The use of the drill in planting these crops is recommended. If it is intended to put the land in grain a second year, &c., &c., as soon as the crop is harvested turn the stubble under with a

two-horse plough, and repeat the process of preparation by sowing cow peas and ash element as already described.

"The peas have been sowed broadcast at these farms, but every one will sow and cultivate them in the manner experience teaches him to be the best.

"The 'ash element' mentioned above consists, as the name indicates, of the most important element of the ashes of plants, viz: lime, potash, and phosphoric acid. It is prepared simply by mixing in equal proportions, calcined marl, of the great eocene marl beds of the coast; South Carolina phosphate ground to an impalpable powder (showing under the microscope 30,000 particles to the linear inch), and alkaline salts (kainit) from the mines of Stanfurt, Germany.

These experiments have attracted the attention of many intelligent farmers in the State and elsewhere. In many instances they have been tried on a larger scale, and in every case when fairly tested, so far as I have been able to learn, with like success. Indeed, evidence goes to show, by the gradual improvement on land year by year to which the system has been applied, that the process is cumulative rather than exhaustive. Nor has it been confined only to small grain and grass crops, but has been equally successful when applied to cotton, corn, potatoes, turnips, etc.

Would it not seem worth while, then, in the face of these results, for farmers everywhere to put these principles practically to the test? These are not theories, or speculations, or laboratory experiments only; they are facts proved in the field under the most trying circumstances. I am aware that they contradict the assertions of many acknowledged authorities on agricultural chemistry. There are, however, some exceptions to the rule.

Dr. Charles Graham, professor of chemical technology, University College, London, in an exposition of his views on the use of unvitriolated phosphate of lime, published in the *North British Agriculturist*, February, 1881, writes:

"The suggestion of Liebig and Lawes that the slow-acting, half-inch bones should be submitted to the vitriolating process, whereby soluble phosphate is formed, was at one time of some value, since it gave agriculture a convenient means of distributing over the land an easily soluble substance in the place of the pieces of bone previously used, and which were slowly decomposed and dissolved, owing to the size, the gelatine, and the fatty matters. With coprolites the suggestion was readily adopted, and, as years rolled on, acid was more and more used in the preparation of phosphatic materials, until at last these indeed became rather vitriol carriers to the profit of the manure manufacturers than to the benefit of agriculture.

"Analytical chemists attached so high a value to the soluble phosphate that the factor 30 became with many the multiplier in calculating the commercial value from the centesimal composition of superphosphates. Some, indeed, went beyond this, and in time analytical chemists came to think of soluble phosphate as the only test of vitriolated phosphatic minerals, the insoluble being regarded as of little or no use. The vitriol makers had good cause to rejoice at Liebig's suggestion and its extravagant valuation by those who followed him. As chamber acid may be profitably made at £2 10s. (\$12.50) a ton, there was every inducement to saturate manure with it, and analytical chemists stimulated this abuse. Now, more than twenty years ago I wrote to the *North British Agriculturist*,

attacking the highest valuation of soluble phosphate. A manufacturer in reply attempted to controvert my arguments by allusion to the cost of his plant, and by the, to him, cogent argument that analytical chemists should be the last to attack manufacturers who gave them employment."

In another communication addressed to the *North British Agriculturist*, January, 1869, Dr. Graham explains his views as follows:

"The employment of sulphuric or hydrochloric acid with phosphate of lime, dating from the time of Liebig's and Lawes' recommendation, has led agriculturists and chemists in a great measure to ignore, firstly, the real use of the acid, and secondly, the mode in which plants take up phosphate of lime. At first it was very generally assumed that the acid phosphate in the manufactured superphosphate remained in a soluble state in the soil until absorbed by the plant. There are, however, few who now doubt that the acid superphosphate when mixed with moist soil becomes again insoluble, either from the action of lime in the soil or of the clay. Clay is the more general agent in this change.

It is, however, beyond my present purpose to consider the chemical compounds formed by this re-insolubility of superphosphates in the soil. This change is a rapid one, a few days, or at most a few weeks, sufficing to destroy the solubility (*i.e.*, in pure water) of the manure. It may be asked: How, then, account for the great benefit to agriculture which was undoubtedly experienced by the adoption of Liebig's superphosphating principles? The answer to this is simple. Before Liebig's recommendations green bones, the size varying from quarter of an inch to half an inch, were used for grass, turnips and other crops.

"Of course, in such a mechanical state the action was slow, hence it was found that by treating them with acid the action was quicker, or, in other words, that a much less quantity would suffice for a given crop. The action was chiefly a mechanical one. The sulphuric or hydrochloric acid employed acted as a grinder, hence the bones were distributed more evenly in the soil, and presented to the solvent agencies therein an enormously increased surface of action. This, setting aside for the moment the value of the gypsum formed in the superphosphate, and which, when desired as manure, may be had cheapest as gypsum, is the solution of the benefit experienced in the adoption of the superphosphating theory. The real solvent before absorption by the plant is in all cases carbonic acid water; the humic, ulmic, and other organic acids arising from the oxidation of the vegetable matter, more or less found in all soils, may or may not form solutions of phosphate of lime, and be taken up as such by the plant.

"Be this as it may, carbonic acid is the final product of the oxidation of vegetable matter, and is sufficient for explaining our present need. Limiting ourselves, therefore, to the consideration of carbonic acid water we see that the whole process may be explained in the absorption by the capillaries of the solution of the neutral phosphate in carbonic acid water, and the subsequent deposition in the cells of the plant of the phosphate and carbon, the oxygen and the water being for the most part exhaled.

"This absorption of phosphate of lime is, of course, coeval with the origin of vegetation, and therefore prior to the use of superphosphate of lime. It seems, to me, that agriculturists should now consider whether this expensive vitriol process may not be with advantage superseded by the older and simpler methods of nature."

*The Bermuda is a perennial grass, whose roots take complete possession of the soil and hold it, to the exclusion of all summer plants, even of broom-sedge. It requires, however, a very rich soil to make it grow thick and high enough to cut. Under favorable circumstances it makes two heavy crops of delicate grass during the summer, which dries easily, keeps well, and is second to none in feeding value.—Dr. R.

†To determine whether it were necessary to turn in the green vines, always a difficult and troublesome operation, some of the dried vines were washed in a filter with water, the water tested, and found to contain all the valuable constituents of the vine, showing that no loss of fertilizing material had been occasioned by the plant dying on the surface of the land, and proving the turning in which has greatly prevented the general adoption of this mode of fertilizing to be unnecessary.—Dr. R.

‡The dried vines of the cow-peas sowed with ash element were found by Dr. Ravenel to contain nitrogenous matter capable of producing 2½ per cent of ammonia, and 10 per cent of mineral matter or ash. The continuous use of the pea as a fertilizer has not proved satisfactory where a liberal supply of mineral matter has been omitted.

Dr. Graham then goes on to suggest the composting of the finely-ground mineral or bone phosphate with farm-yard manure as the cheapest carbonic acid manufactory, or where that is scarce, with turf, leaf-mould, sawdust, &c. Employed thus, or added in a ground state to a highly vegetable soil without previous preparation, he maintains that mineral or bone phosphate in a fine state of division will act as quickly as ground, boiled, or green bones, or even as superphosphate itself. In France, and more particularly in the lands of Brittany, mineral phosphates have been largely used without any previous preparation for years on poor, miserable land and yielding now large and profitable crops of cereals and roots. But in all ordinary cases he recommends composting with vegetable matter, such as dung, turf, &c., before spreading on the land.

An important consideration for the farmer, "says Dr. Graham," is that the present superphosphating method is not only unnecessary but expensive. For an equal outlay he may obtain three or four times as much phosphoric acid when purchased in the raw-ground state as in the ordinary superphosphated condition. The former would, in my opinion, do better were he to employ the money saved in the purchase of the cheaper article by expending it, not in vitrol, for which he pays so dearly in superphosphates, but in the purchase of nitrogen, and especially as regards root crops in the purchase of potash."

From the foregoing it will be seen that Dr. Graham not only advocated the use of finely-ground phosphates of lime, but suggested a method of employing them as manure as early as 1867. Experiments were made at his suggestion in Germany and on a larger scale on the borders of England and Scotland, and his views were published in foreign journals, which have been translated, or re-appeared in English agricultural journals, and in pamphlet form by Messrs. Crossman & Paulin, fertilizer manufacturers of Berwick-on-Tweed, who have done much to introduce Dr. Graham's views into England.

Many thousand tons were thus used in this way without the addition of any acid in France, Germany, England and Scotland, and have continued to be so used in spite of the efforts of grasping monopolists who avail themselves of the generally assumed high value of soluble phosphates to increase their high profits by drenching dear phosphates with cheap acids, and selling the products at the same or even at an enhanced price as a better article.

More recently, and following in Dr. Graham's footsteps, Professor Thomas Jamieson, University of Aberdeen, and chemist of the Aberdeenshire Agricultural Association, has been conducting a series of elaborate experiments to test the value of the nitrogenous matter in bare manure, and the comparative value of soluble and insoluble phosphates, mineral and animal, as a manure for turnips. Writing the 13th of May last, and enclosing a complete series of his reports from 1875 to 1881, inclusive, Mr. Jamieson remarks that during the past season his experiments have been so conclusive that his interest in the phosphate question as a question has ceased to exist.

In the last report for season, 1881, which is the unfinished proof not yet issued to the public, he reproduces for the sixth time his conclusions now final as follows:

"1. Non-crystalline phosphate of lime, ground to a floury state, applied to soil deficient in phosphate, greatly increases the turnip crop, to a less extent the cereal and grass crops, but always with equal effect, whether it be derived from animal or mineral matter.

"2. Soluble phosphate is not superior in effect to insoluble phosphate, if the latter be in a finely disaggregated form, (e.g., disaggregation effected by precipitation from solution or by grinding bones after being steamed at high pressure).

"3. Nitrogenous manures used alone have little effect on root crops (unless the soil is in the unusual state of poverty of nitrogen and wealth of available phosphate).

"Nitrogenous manures used with phosphate give a visible increase of root crop, but this increase is due mostly or entirely to excess of water in the bulbs.

"Nitrogenous manures exert a great influence on cereals, the effect of phosphate on such crops being subordinate. The increase of nitrogen in this case is not accounted for by excess of water.

"As to the relative efficiency of different forms of nitrogen, the ultimate effect of nitrogen in sulphate of ammonia, in guano and steamed bone flour is nearly identical, whether used with soluble or insoluble phosphate. Nitrate of soda, when used with soluble phosphate, is identical also with the above forms, but is of less efficacy when used with insoluble phosphate.

"4. Fine division (or perfect disaggregation) of phosphate assists the braird nearly as effectively and fully as healthily as does the simultaneous application of nitrogenous manures.

"The most economical phosphatic manure is probably non-crystalline, floury, insoluble phosphate of lime, the cheapest form being mixed with an equal quantity of the form in which the highest degree of disaggregation is reached. At present these two forms are respectively ground coprolite and steamed bone flour."

Mr. Jamieson, moreover, notices in his report the conclusions of the International Congress of the Directors of Agricultural Experimental Stations, which was held in Paris, June, 1881. Here the subject of phosphates received much attention also, and general approval of the efficacy of the undissolved forms was the result.

From the records of the Congress it appears evident that the French and German agricultural chemists are now in accord in regard to the comparative value of soluble and precipitated phosphates (i.e., those which had once been soluble but have returned to the insoluble state in fine division), which French chemists have for some time held should be on an equal footing. The French chemists in Congress, therefore, as Mr. Jamieson remarks, assented all the more readily to the doctrine of the value of raw ground phosphate of lime, as in so far as precipitated phosphate was concerned they themselves had been travelling on the same line.

The words of the declaration of the Congress are as follows:

"The Congress is of opinion that in reports of analyses the directors of stations should state the solubility of phosphates by the expressions, phosphoric acid soluble in cold citrate of ammonia, or soluble in water, and not that of 'assimilable phosphoric acid.' The Congress believing that to apply the term assimilable to the phosphate soluble in the citrate would be to class implicitly and necessarily in the category of substances not assimilable the phosphates which are evidently soluble in the soil, such as those in bone ash, guano, bone powder, farm-yard manure and fossil phosphates."

In commenting on Mr. Jamieson's experiments in Scotland, Mr. L. Grandean, commissary general of the Congress and dean of faculty of science, University of Nancy, records:

"These conclusions generally resemble, it will be seen, those which I have made from my eight years' experiments. They confirm notably the

important fact of the identity almost of soluble and of precipitated phosphate. The general conclusion of the Aberdeenshire experiments is that the tribasic phosphate in fine powder is the most economical source of phosphoric acid to the cultivator. We are then, Mr. Jamieson and myself, absolutely in accord upon this very important economical fact, that it is necessary to substitute in cultivation on the large scale the raw mineral phosphate in fine powder for the infinitely dearer superphosphates.

Among other chemists who have experimented in England may be mentioned Drs. Lawes, Provost, Cameron, Vælleker, Baldwin and Aitken, all of whom have confirmed the value of fine-ground phosphates as far as under the circumstances was to be expected, though some of these have been reluctant to abandon the old land marks. In a paper on "Co-operative Experimenting as a Means of Studying the Effects of Fertilizers and the Feeding Capacity of Plants."

Professor O. W. Atwater says: "Treating the insoluble phosphate of bone or mineral phosphate with acid to make superphosphate is expensive. Soluble phosphoric acid costs us from twelve to fifteen or more cents per pound. While we can buy it in the mineral forms for from four to six or seven cents. The general theory is that superphosphate is necessary, but still, some how or other, many of us have the feeling that, in many cases at least, the cheaper insoluble phosphates would do as well, that fine grinding might serve instead of superphosphating, and that there are many cases in which the cheap rock phosphate might replace the dearer bone manure. If, so, the saving would be immense."

Such then are the views and conclusions of some of the leading chemists and agriculturists abroad and at home, who concur in the use of fine-ground unvitriolated phosphates in place of the superphosphates. We are therefore not alone in our views on the subject, the question is not one which is confined to any one locality or soil, but is of high economical importance to agriculture in general, and may well agitate the whole world.

Now, it must not be supposed that in expounding Dr. Ravenel's views I claim for him that he was the first to suggest the use of unvitriolated phosphates, for long before the discovery of phosphates in South Carolina, and prior to Dr. Graham's experiments or even Liebig's recommendations, it is well known that bone phosphate in a powdered condition was largely used as a fertilizer. But as some misconception may arise in regard to the originality of Dr. Ravenel's suggestions I deem it necessary to state wherein he differed from Dr. Graham or any other chemist. Dr. Graham, as we have seen, gives the solution of tricalcic phosphate in carbonic acid water as the true explanation of the nourishment of plants. Dr. Ravenel believed that the acid contained in the root of the plant itself was the active agent in dissolving the plant food. These two theories of the same result are comparatively of little practical importance to the farmer.

The vital feature, however, of Dr. Ravenel's system, of which we must not lose sight, is the employment of the leguminoids along with the necessary mineral matter not only to assist in preparing the soil for future crops by furnishing the vegetable acids, but also to act as cheap carriers of nitrogen. Farm-yard manure is often scarce, but in any case when applied on a large scale the legumes effect the same end in a very much simpler and cheaper way. In like manner clover, together with "land-plaster," has been used to some extent in Virginia, and some recent experiments of Sir J. B. Lawes in England seem

to indicate a similar employment of legumes; but this systematic method of applying different legumes with all the mineral matter needed at different seasons to suit the various crops of grass, of grain, of cotton, &c., is entirely the suggestion of the late Dr. St. Julien Ravenel.

In conclusion there are some points about the economy and application of raw-ground phosphates which I wish to make clear.

In writing to me on the subject some farmers have expressed surprise at the comparative cost of soluble and fine-ground phosphates, both being sold, I believe, at very much the same price. What they ask is the economy of the one over the other? The answer is this: In the acid article the farmer gets in a ton of fertilizer only about half a ton of phosphate of lime, whereas in the raw-ground rock he gets a whole ton. At the present price of crude rock the finely-ground product is certainly dear enough, that is to say, as much or more is charged for grinding as the rock originally cost.

But as the acid in the superphosphate acts chiefly as a grinder, and a ton of superphosphate costs as much or more than a ton of ground phosphate, and yields but half the quantity of fertilizing material; there is no doubt as to the economy of the fine-ground rock.

There is no one word since the introduction of artificial fertilizers which has so misled farmers or cost them more money than the word *soluble*. For what does soluble or superphosphate mean practically to the farmer? It means that his phosphate is in such a condition that it may be washed out in the drainage waters, and that at a time when the plants most need it, viz: in the later stages of their growth it has disappeared; or it means that the possible liberation of a quantity of acid in the soil, owing to the chemical action taking place, is liable rather to exhaust than improve his land. And yet this is the article for which two prices are paid; instead of using the simpler and cheaper raw-ground phosphates which remain always stored up as in a bank in the soil for nature to draw checks on as required. But it must be understood that the finer ground the plain phosphate is, and the more uniform the powder, the more complete will be the manurial effect. Again, as I have already pointed out, the use of phosphates, or of any one element of plant food alone will not have the desired effect, unless the other necessary elements are present in sufficient quantity in the soil. Therefore, the phosphate ground to the finest possible state of division (an impalpable powder) is to be mixed with the mineral matter needed, lime and potash, and then composted with farm-yard dung or other vegetable material, or better still, and along with the legumes, which furnish also the necessary ammonia. If farmers will apply the finely-ground mineral phosphates *under these conditions*, I am convinced that they will find them efficacious as well as economical. I do not expect any one to adopt these views all at once or without a trial. I have a greater respect for the farmer's proverbial common sense; but I do expect all to try this thing for themselves. Do not ask your would-be experienced neighbor, do not ask your chemist or fertilizer dealer, but go the land and ask it the question!

And especially I urge our southern farmers to give the matter their earnest consideration. We are an agricultural people. The two essentials for plant growth are force and material. The forces are light, heat and water; the materials, lime, phosphate and potash, carbonic acid and ammonia. Our climate affords the forces in the highest degree of perfection; the materials are most of them at our very

doors. There is no reason why we should not make this one of the most blest regions on the globe, if we will only make use in a rational manner of the means with which nature has provided us.

The Value and Importance of Canadian Phosphates as a Fertilizing Agent.

(Excerpted from the Blue Books of the Hon. John Carling, Minister of Agriculture.)

The farming community of Canada, as a whole, seem to be very backward in applying artificial fertilizers to their soil, contenting themselves with the simple old time barnyard manure. With the annual exhaustion resulting from continuous yield, this is not sufficient of itself to produce the results in Canadian grain that the present system of farming might be expected to yield.

The Dominion Government has by no means neglected to bring this matter before the public, as the following extracts from its blue books show. The Minister of Agriculture, in his Report to Parliament for the year 1878, commenced to call attention to the application of phosphate as a fertilizer in the following remarks:—

“The fact of the ascertained existence of phosphate of lime in very large quantities in the Provinces of Quebec and Ontario, is of very great importance for the agricultural interests of the Dominion.”.....

“Canada is really now emerging—at least the old Provinces of the Dominion are—from the position of what may be called new-land farming, a system to a great extent dependent on the unused resources of the virgin soil, which contain the requisites for producing the cereals and grasses without resort to artificial manures. While this state of things has existed in Canada, the Old World has drawn from Peru and other countries, guano and other manures, to enable it to get returns from the soil which the old Provinces of Canada have been drawing from decayed vegetable and other deposits, everywhere found in land recently cleared of the forests. But while this virgin soil enables the new-land farmer to obtain the cereal and other crops without the expense of purchasing artificial manures for a considerable length of time, it happens in Canada, as in other countries, that the necessary properties for the production of wheat and other crops will become exhausted in the proportion that they are taken from the soil, without the return to it of the necessary fertilizers to counterbalance the exhaustion from the crop..... In many of the old parts of Canada, it has been found in places where wheat was at one time easily and profitably raised for export, the soil has become so much exhausted from cropping, that grain can now only be profitably grown by the use of artificial and other manures, in the same way as in the Old World, by a very careful system of farming and the use of such manures.

“Peruvian guano, which has been so largely used for this purpose, seems to be diminishing in quantity, and it is, therefore, fortunate that the fact of the existence of immense deposits of phosphate of lime in Canada has become known. This occurs, also, at a time when the necessity for a change in our system of agriculture has become apparent. It is not, however, the agriculturists of Canada alone who are to be benefited by the discovery which has been made.

“Already the phosphates of Canada are being used in England, Germany and the United States. English, German, and Canadian companies are engaged in the mining, and the trade bids fair to become a large and profitable one. So important, in fact, is this trade likely to be,

that it is desirable to ascertain how it can be fostered and utilized to the greatest advantage to this country.

“The percentage of purity of the ascertained large deposits of phosphate of lime is from 70 as high as 95, and this coupled with the proximity of iron pyrites appears to afford the conditions necessary for an easy and cheap manufacture of superphosphates. Such manufacture would employ the labour of our own country.”

In 1880 he again alludes to it as follows:—
“The necessity for the use of artificial manure in the production of wheat and other crops, becomes yearly more and more apparent, and especially on this continent where the virgin soil is becoming exhausted by continual cropping, and a return to it of the requisite fertilizers is absolutely necessary for profitable cultivation.

“Practical experience has shown how some of the older States, whose soil was considered inexhaustible for wheat growing, are now far behind the Western States and Manitoba, against the products of which, from virgin soil, they can only compete by heavy use of artificial and other manures.

“From the fact of a fertilizer in our midst, only requiring to be manufactured, it can readily be seen what facilities are afforded Canadian agriculturalists for its use, compared with Europeans, who have to pay the freight and other charges on the same material even in a crude state.

“I strongly call the attention of our farming community to the use of this native product, a demand for which, in a manufactured state, would soon call into existence works for the same amongst us; and such manufacture would employ the labour of our own country.”.....

“It is to be hoped that increased attention will be paid to the phosphate industries, and the results of experiments in the use of this fertilizer be noted and made public.”

In 1881 is found as follows: “The percentage of purity of native Canadian phosphate ranging from 70 to 95 per cent, affords a condition well calculated to induce our agriculturalists to use it. Even in its raw state, when reduced to a fine powder, experiments have shown that it produces valuable results. The production of wheat and other crops exhaust from the soil the necessary properties for their growth, and this can be only counterbalanced by a return to the soil of suitable fertilizers. As the virgin soil turned up by the early settler has year by year had drawn from it its requisites for producing cereals and grasses, so the time has now arrived when it will no longer produce remuneratively without resort to artificial manures. Prof. Hoffman, the analyst to the Geological Survey staff, considers that from its usual high percentage Canadian phosphate may be regarded as ‘most eligible.’..... “I would again, as in my last Report, urge the attention of our farming community to the use of this native product, a demand for which would necessarily call into existence works for its manufacture at our very doors.”

Again in 1882: “Considerable attention is being paid in various quarters to its use in the raw state pulverized, but the beneficial effects are said not to be visible during the first year. Experiments to test its appliance in this state have been made at the Agricultural College, Guelph, but the result has not been made known. From present indications considerable attention will be paid to phosphate mining and shipment during 1883.”

“There has been a tendency in some of the old provinces to cultivate continuously the cereals on rich virgin soils, and this process, whatever may be the natural wealth of the soils,

conduces to deterioration. This may be obviated by the application of artificial manure, capable of imparting recuperative properties to the soil. Experiments have shown that phosphates, especially when chemically prepared, possess these qualities in a very high degree. I would strongly urge a trial of its effects, and the comparison of the yield of grain afforded by land thus treated, with that on land without this stimulant. If an active demand were created for manufactured phosphate, its preparation would also largely aid in employing the labour of our country."

In 1883 he says: "When Canadian phosphate first came on the market, some eight years ago, practical men shook their heads at the hard and unpromising looking material. Many of the mills then in use in fertilizer-works were the buhrstones used to pulverize coprolite and other comparatively soft material. The difficulty of grinding has now been overcome, and it is no longer a source of danger to workmen, and of perplexity to manufacturers. Instead of using it as they did coprolite, it is mixed largely with other softer materials, which enables the operating chemist to first saturate the raw phosphate with sulphuric acid, and use Canadian phosphate as a drier."

"Being a more concentrated phosphate than any other in the world, it has very naturally been sought for to bring up the acid phosphate fertilizer to high percentages of phosphoric acid." "I have in previous reports, remarked that the removal by crops impoverishes the soil, and prevents it from yielding as abundantly as formerly, unless the loss is compensated by supplying phosphate fertilizers. In the districts where cattle raising is not carried on, the absence of ordinary manure must be compensated for by some artificial stimulant and experience goes to prove that for the production of cereals of every description as well as for the strengthening and renewal of worn out lands, no available fertilizer is known that can produce such beneficial results as phosphate when subjected to a chemical process, and known to the trade as super-phosphates."

"The grain exported from the port of Montreal in a single year, has been estimated to contain 2,574 tons of phosphoric acid, which implies the total exhaustion, as far as phosphates are concerned, of 75,000 acres, the renewal of which necessitates the application of some 6,000 tons of phosphates."

In 1884 he still more strongly points out the benefits to be obtained from its use—"The use of Phosphate as a fertilizer, when converted into Super-phosphate, cannot be too strongly urged on our farming population, and the advantages it offers in renewing lands worn out by perpetual cropping, in the absence of ordinary manure, the want of which is too often apparent in districts where cattle-raising is not carried on, cannot be too often impressed. In those parts of Europe where the sugar beet is largely grown—Belgium and Denmark for instance—no fertilizer has been found equal to phosphate, and the same remark might well be applied to the grain producing farms of our older provinces. The rigid inspection to which the crude material is subjected in England tends greatly to keep up the standard of our shipments, and the high percentage of Canadian phosphates will always secure for it a foremost place and an eager demand. Prof. Dawkins, comparing the phosphate obtained from various countries, states the percentage that Canada yields out of a mean of analyses, is 87.52 of tribasic phosphate of lime."

"The question has not yet been solved whether the raw material pulverized will give beneficial

results to the soil by its application, and till this fact has been ascertained, the crude phosphate will continue to be shipped to the place of manufacture. The establishment of works for its conversion into Super-phosphate, contiguous to the natural deposits, would prove of immense advantage, as the material thus converted would be far more likely to be made use of by our resident agriculturists, and transport of bulky phosphate would be resolved into shipments of a substance commanding a far higher price. The advantages obtained by foreign manufacturers would in that case be gained by Canada, and an industry might be added to those already existing which would materially add to our prosperity." "It seems to me a matter of regret that no definite action has yet been taken in regard to the conversion of crude phosphate, into superphosphate ready for use. If the manufacture of the prepared fertilizer was carried on in Canada, much larger returns would be obtained for the shipments of it made to Europe, and a considerable saving would occur in the cost of freight, as, under the present conditions, however carefully the system of collecting the crude material is carried on, there are still quantities of foreign matter associated with it, which are valueless when separated by the manufacturer. I have ascertained that the mineral from which the acid requisite for converting phosphate into superphosphate could be extracted, is present in proximity to the phosphate itself, but no steps appear to have been taken towards the manufacture of this commodity, either for home use, or for foreign export. I am, however, in hopes that with the attention the phosphate mines have received within the past year, both from members of the British Association who visited them, as well as from capitalists with a view to investment, and as the output of the crude material increases with the development of new mines, this important question of its conversion into a form ready at once for the use to which it is to be applied, will occupy the serious attention either of those at present engaged in phosphate mining, or of those who might make its manufacture a separate branch of industry."

In 1885, he again calls attention to it, and in the appendices to the Report for that year, on page 204, an instructive report on "Canadian Phosphates" in relation to agricultural use is furnished by Mr. H. B. Small, which goes very fully into the history of phosphate and contains much valuable information on the subject.

"During the past two years, owing to the attention that has been given to it, the product of Canadian mines has increased in favour with manufacturers of superphosphates. I would particularly call attention to the use of this natural product as a fertilizer to be used by our farming population. It is an established fact that wheat contains about $\frac{2}{100}$ per cent. of phosphoric acid, or about 16 pounds to each ton, and when the total shipments of wheat from this country are taken into consideration, the amount of phosphoric acid taken from Canadian soil and sent away in the wheat can easily be estimated. This loss to the soil requires the most powerful fertilizer to replace or compensate for it, and the only fertilizer known of a sufficiently high grade to effect this is phosphate of lime, when converted into superphosphate. Diversity of opinion prevails respecting the beneficial result to the soil by the application of the material in a raw pulverised state. The experience of agriculturists in the Southern States, where this fertilizer is largely used, both in the raw and prepared conditions, is largely in favor of the latter form for immediate returns, and that when the raw substance is used it should be in

combination with some other fertilizer of pronounced condition and fertility. From experiments made in the States referred to, the following deductions may be informed:—For prompt and immediate results, superphosphates, and for slow and continued results, ground phosphates are respectively valuable."

In 1886, the Minister again calls the attention of the agricultural community to the necessity of the use of fertilizers:—"When Liebig, in 1840, compelled the agricultural community to accept his views of exhaustion and restoration of the soil, and that the constant removal therefrom in harvest of the inorganic elements of plant food, notwithstanding the rotation of crops and the old system of manuring, was a robbery of the soil, which gave a present increase at the expense of the future, he founded an industry which has assumed constantly increasing proportions ever since. That industry is the manufacture of fertilizers or superphosphates, and the demand for materials with which it can be manufactured has led to a search for, and consequent working of, natural deposits in which phosphate of lime preponderates. The whole art of manuring consists in supplying the natural elements of plants in a form most favourable for absorption and assimilation, and, as ordinary manure does not always contain the most important inorganic elements required, phosphoric acid, and potash sufficient for plant use, the needs of mankind demand the employment of artificial fertilizers along with, or as a substitute for, barnyard manure."

"The attention of our agricultural community cannot be too strongly drawn to the necessity for the use of fertilizers, although the chief portion of the phosphate of lime which is produced in Canada is shipped in its crude state to Great Britain and the Continent, there to be manufactured into superphosphates, a considerable portion of which is shipped to the United States."

In 1887 he further says—"The question of using ground phosphate in the raw state is attracting considerable attention, and a series of tests will be made at the Experimental Farm during the coming season, the results of which will be made public. The manure question is one of the most important connected with agriculture, and whatever will tend to an increased production of crops must necessarily demand the attention of the agricultural community. Phosphate rock has now, to a great extent, been substituted in place of bones in the manufacture of superphosphate and commercial fertilizers, by treatment with sulphuric acid, for the purpose of rendering it soluble. Phosphoric acid, as contained in crude phosphate, has been considered insoluble in water, but water containing carbonic acid, ammonia, or common salt, has the power slowly of liberating the phosphoric acid from its basic lime, and rendering it soluble for plant food. But the slower operations of water to render the phosphoric acid available for crops, can be largely increased by mixing the pulverized material with fermented manure, or peat. This system has for several years been carried on in the United States, in connection with cotton and tobacco plants, both of which being very exhaustive to the soil, require very stimulating fertilizers to restore the growing properties essential for plant life to the land. It is to be hoped that our farming community will see the necessity of adopting some measures for keeping the land required for the use of cereals, up to its standard, by using fertilizers, and it does seem anomalous that this rich natural product at our very door, should be shipped away to the United States and Great Britain without its

value being recognized by our own farming community."

Last year, 1888, he not only still more strongly brings the matter before the public, but quotes from the "London Times" and "Morning Post," important references to the subject, made by those papers. "I continue to hope that the time is not far distant when our own farmers will see the advisability of using this fertilizer at home, which would have the effect of largely increasing this mining industry. Late advices from Great Britain show that Canadian phosphate is prominently engaging the attention of superphosphate manufacturers in that country, and the enormous deposits in this vicinity may be expected to receive thereby still more attention than has been the case in the past. I am informed that British agriculturists have been discussing of late the present position of their supplies of phosphate, that most essential element of plant food. It appears, from the inquiries of the Chemical Manure Manufacturers' Association, that the great guano beds of Peru and Chili are approaching exhaustion, and the British farmer seems timid lest the growing home demand for the phosphates of the United States and Canada, in those countries, should greatly curtail the British supply from these sources, and leave the British farmer without an adequate quantity of artificial manures at anything like reasonable prices. At this moment, therefore, special attention is being drawn to the Canadian deposits." . .

Facts like the above show that the farming community have been very strongly urged to remedy the impoverishment of the soil, which naturally takes place by continuous cropping, by the application of a fertilizer produced almost at their own doors, and the results of a want of action in this matter are only due to their own lack of interest, and not to any inaction on the part of the Government.

From the above extracts, the Canadian public will see that the Minister of Agriculture has done his share towards calling attention to the need of artificial fertilizers.

Nitrates v. Phosphates.

The frequently-quoted simile referring to the respective merits of nitrates and phosphates, as a plant food, that "the nitrate is like a glass of spirits, the phosphate like a plate of beef," is an exceedingly terse way of putting a generally acknowledged fact that, while the former is a mere stimulant, the application of phosphate adds permanently to the fertility of the soil. The simile, however, might with equal accuracy be continued as follows:—"But a combination of the two is like a substantial dinner."

The application of science to agriculture is of comparatively recent date, but, nevertheless, the progress in agricultural chemistry has wrought, as was to be expected, a corresponding advantage in the art of farming. It was soon ascertained that the artificial barrenness produced by exhaustion yields, under proper conditions, to the touch of science. Certain constituents, it was found, are indispensable for plant growth, and of these the largest quantities were continually being withdrawn. Chief among these constituents are phosphoric acid, nitrate of potash or soda, and ammonia. Most agricultural soils contain sufficient iron, magnesium, calcium, chlorine, sodium, and sulphur to last for ages, but the disproportion between the amount of the three former ingredients required by plants and the amount replaced in the soil by nature is so great that exhaustion of these elements follows as the necessary consequences of continuous cropping.

The application of science to agriculture resulted in nothing more and nothing less than the creation of a new industry, namely, the production of "commercial fertilizers."

The introduction of artificial fertilizers marks, therefore, a new epoch in the history of agriculture. Their general acceptance in common farm practice is equivalent to the introduction of a new force. They have revolutionised the mode of agriculture as thoroughly as steam and electricity have revolutionised transportation and commerce. By their judicious application a barren soil can be changed into one of great productiveness. Therefore the principal functions of a good fertilizer are to supply to the soil the three elements of plant-food usually wanting in poor or exhausted lands, viz., phosphoric acid, ammonia, and nitrate of potash or soda.

The application of scientifically prepared concentrated plant-food to the soil forms a means of estimating the progress which a country is making in the domain of agriculture. The marvellous ease and rapidity with which France paid off the enormous war indemnity of five milliards of francs has justly taken the world by surprise. Yet to a great extent it was due only to the wealth Frenchmen knew how to derive from the land they live on by a generous and intelligent method of farming, and to nothing else can this be ascribed but a practical recognition of the value of artificial manure.

Is it not strange, therefore, in the year 1889, when it has been clearly and repeatedly proved by all the leading scientists of the day, as well as by practical demonstration, that each and all of the three elements enumerated above are requisite and necessary to form the basis of a satisfactory and practical fertilizer, that men of intelligence can be found antagonistically debating the respective merits of phosphoric acid, as represented by the general term of "phosphates," and nitrates of soda and potash, usually designated "nitrates"? This is clearly attributable, however, not to a lack of knowledge of the scientific facts as they exist, but because of the different financial interest involved in the two industries, thereby causing an undue advocacy of the particular chemical ingredient in which the several parties have embarked their capital.

The time is rapidly approaching when such a state of things must end; already those most largely interested in the nitrate industry have accepted the teachings of science in regard to this question of superiority or inferiority of the respective elements, and—appreciating the certainty of an almost universal demand in the future for a concentrated fertilizer containing all the beneficial qualities to be derived from a judicious combination of phosphoric acid and nitrate of potash—are alive to the necessity of securing a substantial interest in the comparatively limited supply of the crude phosphate rock.

The average farmer's knowledge of plant, physiology, and agricultural chemistry is, as a rule, of a very limited nature. He is not able to determine for himself what are, or what are not, those essential elements of food plants which he desires to procure for his land; but he is rapidly becoming educated up to a proper understanding of the various elements, and their relative value to the soil.

The literature published by the Royal Agricultural Society of England and the Bath and West of England Society is having a very beneficial effect in this direction, and the statistics and results of experiments therein published have in the past, and will still more in the future, clearly demonstrate that the very best results are to be derived, not from the use of nitrates or superphosphates alone, but by an

intelligent use of the two in combination.

As evidence of this, Mr. J. E. Knowles, the chairman of the Experimental Committee of the Bath and West of England Agricultural Society (1888-89) states in his report that the results of twenty-four experiments in relation to wheat-growing showed "that nitrate of soda and sulphate of ammonia, when combined with superphosphate, have each given a larger produce both in corn and straw than either used alone." In the same publication the same satisfactory results were noted in reference to the oat crop. Experiments were made on $\frac{1}{2}$ -acre plots with the following results:—"The unmanured plots produced at the rate of 21 bushels per acre. By spending £1 1s. an acre in nitrate of soda (70 lbs.) and superphosphates (168 lbs.) the produce of grain was exactly doubled, and there was an increase of straw of 864 lbs., this increase in corn and straw being equal in money value to 2l. 10s., or a clear gain, after deducting cost of manure, say, 30s. per acre."

"In the plots where sulphate of ammonia alone and nitrate of soda alone were used there was a small gain of about 6s. per acre."

Similar experiments on "grass" resulted as follows:—Umanured, 4 cwt. 1 qr. per acre of hay; sulphate of ammonia, 5 cwt. 2 qrs. of hay; nitrate of soda, 5 cwt. 1 qr. 7 lbs. hay; nitrate of soda and superphosphates combined, 6 cwt. hay.

No clearer proof can be required to demonstrate beyond a doubt the unquestionable advantage of this combination, and it will be unnecessary, therefore, to trouble the reader with detailed results of the numerous other trials made.

That both the nitrate and phosphate industries have reached gigantic proportions, notwithstanding unreasonable opposition, may be gleaned from the following figures:—

	Tons.
Nitrates used annually in the United Kingdom and Continent	600,000
Nitrates used in United States (about)	90,000
Phosphates imported into United Kingdom alone (1887)	283,415
Superphosphates and fertilizers mainly based on phosphates, used in the United States (1886)	1,006,631
Of this quantity 616,631 tons were used in the Southern States in the cotton districts.	

It is difficult to estimate to what proportions this business may grow when a loyal combination is once established between the two interests, which, as we have pointed out above, must be the inevitable and speedy result of the march of progress and intelligent agricultural enterprise.

The question then arises—and it is a question which has given great concern to the manufacturers of fertilizers both in Europe and America during the past year—Where are we to look for our future supplies of crude phosphate rock which the satisfaction of this ever-increasing demand for plant-food necessitates? That the question is one of great moment for the consideration of manufacturers is evidenced by the serious anxiety evinced on this point by Mr. Herman Voss—himself the manager of one of the largest fertilizer manufacturing companies in the world—in his admirable paper read before the Chemical Manures Manufacturers' Association on 10th December, 1888. He therein stated:—"The consumption of phosphatic manures, partly owing to the use of large quantities of nitrate of soda and ammoniacal manures, is rapidly increasing all over the world, and our supply is at present dependent upon so few sources that I consider it necessary and advisable to change our mode of selling superphosphate in such a way that we could also draw

from other sources which would strengthen our hands as manufacturers."

It will be noted that Mr. Voss not only expresses anxiety as to the present limited sources of supply of the crude phosphate, but strongly emphasises the fact we have demonstrated above, that any increased use of nitrate of soda, as a matter of course, will increase comparatively the demand for phosphatic manures.

The present imports of crude phosphate rock into Great Britain, as stated by Mr. Voss, are derived from the following sources (1887):—

	Tons.
United States.....	165,275
Canada.....	19,194
Dutch West Indies.....	9,505
British West Indies.....	6,451
Spain and Portugal.....	15,612
Belgium.....	45,322
Holland.....	4,778
France.....	11,140
Australia.....	350
Hayti.....	3,044
Brazil.....	1,200
Other countries.....	1,544
Total.....	283,415

From these figures it will be seen that to supply the requirements of Great Britain alone for the next ten years, provided the demand does not increase, will require an output of about 2,834,150 tons, and it is but reasonable to assume that long before the expiration of that time many of the older sources of supply, from which there has been a continuous drain for many years past, will be completely exhausted. On the other hand, it will be noted that the Canadian supply up to the present has only amounted to about 8 per cent. of the British consumption, notwithstanding the well-established fact that the phosphate deposits in the Dominion cover such an enormous area as to warrant the assumption that in the near future Canada will take a foremost place in the world's supply of this invaluable mineral.

It will be noticed that the largest producing countries at the present time are the United States and Belgium. A reference to Mr. Voss's admirable paper shows that the average percentage of phosphate of lime in the Belgian product is not more than 50 per cent., while that of the United States contains about 60 per cent. The Canadian mineral, as imported into Great Britain averages, however, from 80 to 85 per cent. of phosphate of lime, and may at once be set down as one of the highest grades of phosphate rock the world produces.

When we take into consideration that, in order to produce a really high-grade phosphatic manure compound (for which intelligent agriculturists are year by year becoming more exacting in their demands), it is a necessity that manufacturers should procure a correspondingly higher grade of the raw material—and, if proof of this is necessary, it is to be found in the fact that makers are willing to pay a much higher price per unit of phosphate of lime for the richer minerals than they are for that of poorer quality; thus, for example, while a manufacturer is paying, say, 7d. per unit for a 50 per cent. phosphate, or 29s. 2d. per ton and 9d. per unit for one of 60 per cent., or 45s. per ton, he is willing to pay about 1s. per unit for the higher-grade Canadian, or 4l. per ton for an 80 per cent. grade, and 4l. 5s. for one of 85 per cent.—it must readily be seen that the Canadian miner must always be in a position to produce his material at a decided advantage over any of his foreign rivals.

The question then naturally arises, if this be the case, how is it that the present output is so limited?

The reply is to be found in Mr. Voss's remarks under the head of "Canadian Phosphates," as follows:—

The Canadian mines commenced to be worked some ten years ago, and the output now amounts to about 25,000 tons per annum. Our imports from Canada were:—

Years.	Tons.
1881.....	8,187
1882.....	16,531
1883.....	15,716
1884.....	21,484
1885.....	18,069
1886.....	19,194

So that it will be seen that in six years the output has increased about 250 per cent.

Capital is the agent most required in Canada to build up and develop her mining industries. With it much more could be accomplished; without it Canadians are unable to avail themselves to the full extent of their rich phosphate territory.

Canada offers to the British capitalist a large and profitable field for investment in her phosphate properties. As the great and vital question of the future supplies of fertilizing materials becomes more widely discussed capital will assuredly flow into Canada for the purpose of developing this profitable industry; but it behoves every Canadian, every man interested in the great future of this business, to see that the interests of the British investor are safeguarded by countenancing only those mining schemes which can bear honest investigation, and that will provide a fair and reasonable expectation of returning to those who invest their money in these properties a good and permanent interest on their capital. Otherwise, notwithstanding the glorious future opening out for those at present engaged in the business, capital will seek investment elsewhere, and the advancement of the colony, as well as its mining industries, will be permanently impeded.

Phosphate of lime (apatite) was first discovered in Burgess, Ontario, in 1847. In 1860 the first shipment of the mineral was made, amounting to about 100 tons.

The earliest discovery of apatite in the County of Ottawa was made in 1829 by Lient. Ingall, of the 15th Regiment, while engaged in certain geological explorations. Mining operations were not engaged in until 1873.

The entire phosphate beds of South Carolina, so far as discovered and defined, have been estimated to cover an area of 240,000 acres. It was not known that the rock possessed any commercial value until the year 1865.

In those parts of Europe where the sugar beet is largely grown—Belgium and Denmark, for instance—no fertilizer has been found equal to phosphate, and the same remark might well be applied to the grain producing farms of our older provinces. The rigid inspection to which the crude material is subject in England tends greatly to keep up the standard of our shipments, and the high percentage of Canadian phosphate will always secure for it a foremost place and an eager demand. Prof. Dawkins, comparing the phosphate obtained from various countries, states the percentage that Canada yields, out of a mean analysis, is 87.52 of tri-bassic phosphate of lime.

Our Fertilizer Trade.

As has been pointed out in these columns, farms are constantly being abandoned in Ontario and Quebec, and families are compelled to emigrate to a life of comparative hardship for the sake of newer soils when a knowledge of the means of enriching the old lands, and where these may be obtained, would preserve their homes in comfort and affluence. It is no exaggeration to say that the agriculture of the future depends upon the growth and development of this industry. Already works have been established in various parts of Canada.

The largest now in operation is owned by Messrs. G. H. Nichols & Co., the well known manufacturing chemists of New York. Some years ago, they purchased what are known as the Capelton mines, situate at Capelton, Province of Quebec, and have worked them on a very extensive scale up to the present time. The ores mined, being a sulphuret of copper and iron, were shipped to Laurel Hill Chemical Works, New Jersey (also owned by Messrs. G. H. Nichols & Co.), where they were treated and prepared for market. About two years ago, they decided to erect a large chemical manufacturing plant at Capelton, contiguous to their mines, for making sulphuric acid and other chemicals, also superphosphates. In the manufacture of the latter the apatites from the Ottawa Valley are largely used, being regarded by this firm (who are most competent judges) as the finest quality known for the manufacture of mineral manures.

Messrs. G. H. Nichols & Co., with their various works, manufacture more sulphuric acid than any other concern on this side of the Atlantic Ocean; they have everything known to modern science (together with many things not generally known) wherewith to manufacture, not only economically, but of great purity.

Their works at Capelton are well and conveniently located on the Possumpsic Division of the Boston and Maine Railroad, and at only a very short distance from the Canadian Pacific and Grand Trunk Railways, thus making them accessible to every part of the Dominion of Canada. In answer to our enquiries, the firm writes:

"This spring we decided to commence the manufacture of chemical fertilizers for Canadian farmers, feeling that up to that time they had been at a great disadvantage as compared with their American neighbors, in that fertilizers furnished them had not only been in many instances improperly made, but almost universally at much too high a price to enable them to use them advantageously. We constructed a small experimental works, manufacturing the grades referred to in our advertisement, and while the outlet has not been as large as we could have desired, we have found, on the whole, the farmers to take hold of it with a good deal of intelligence. We have been sufficiently encouraged to believe that our policy of high grade goods at the lowest possible prices was correct, so that we are now preparing to erect in time for the winter trade a large and complete fertilizer works at Capelton, in which we expect to be able to manufacture fertilizers to the extent of several thousand tons per annum by the most approved modern machinery. It is our expectation to distribute this fertilizer through agents in various parts of the country, who will be controlled from our central office, so that there will be no danger of their overcharging farmers. The prices mentioned in our advertisement are what we expect the farmers to pay, any commission for agents being paid by us. If the trade warrants, we are prepared to extend the fertilizer department to any necessary degree, so that Canadian farmers may be certain that they may get all of the fertilizer they want at the lowest possible margin of profit. We simply need their co-operation to make the enterprise a success both for ourselves and for them."

The next manufactory of importance is located at Smith's Falls, Ontario. The works are much older than those above referred to, but not as large. Mr. R. J. Brodie, a graduate of McGill College, has charge of these works. Mr.

F. G. BECKETT ENGINE CO.

MILTON, ONT.



Having had many years practical experience in the
manufacture of

MINING MACHINERY

IS NOW PREPARED TO CONTRACT FOR

Stamp Mill Machinery,
Concentration Mills,
Revolving, Roasting and
Drying Furnaces.
Rock Breakers,
Cornish Rolls for crushing,
Amalgamating Pans and Settlers,
Concentrators and
Revolving Screens,
Smelting Furnaces, Retorts,

HOISTING ENGINES,

EITHER GEARED OR DIRECT ACTION.

Cornish Pumping Machinery,
Iron Ore Cars, Safety Cages, &c.,
Rock Drills and Air Compressors.

STEAM ENGINES AND BOILERS.

Marine Engines and Steam Yachts.

HARRIS AND CAMPBELL

LATEST DESIGNS IN DRAWING ROOM, DINING ROOM AND BEDROOM FURNITURE.

With Improved Steam Machinery our facilities for manufacturing Cabinet Goods are complete. Our Upholstery Department is well stocked with the latest imported patterns.

CORNER QUEEN AND O'CONNER STREETS, OTTAWA.

**DEPARTMENT**

OF

Inland Revenue.**AN ACT RESPECTING AGRICULTURAL FERTILIZERS.**

The public is hereby notified that the provisions of the Act respecting AGRICULTURAL FERTILIZERS came into force on the 1st of January, 1886 and that all Fertilizers sold thereafter require to be sold subject to the conditions and restrictions therein contained—the main features of which are as follows:

The expression "fertilizer" means and includes all fertilizers which are sold at more than TEN DOLLARS per ton, and which contains ammonia, or its equivalent of nitrogen, or phosphoric acid.

Every manufacturer or importer of fertilizers for sale, shall, in the course of the month of January in each year, and before offering the same fertilizer for sale, transmit to the Minister of Inland Revenue, carriage paid, a sealed glass jar, containing at least two pounds of the fertilizer manufactured or imported by him, with the certificate of analysis of the same, together with an affidavit setting forth that each jar contains a fair average sample of the fertilizer manufactured or imported by him; and such sample shall be preserved by the

Minister of Inland Revenue for the purpose of comparison with any sample of fertilizer which is obtained in the course of the twelve months then next ensuing from such manufacturer or importer, or collected under the provisions of the Adulteration Act, or is transmitted to the chief analyst for analysis.

If the fertilizer is put up in packages, every such package intended for sale or distribution within Canada shall have the manufacturer's certificate of analysis placed upon or securely attached to each package by the manufacturer; if the fertilizer is in bags, it shall be distinctly stamped or printed upon each bag; if it is in barrels, it shall be either branded, stamped or printed upon the head of each barrel or distinctly printed upon good paper and securely pasted upon the head of each barrel, or upon a tag securely attached to the head of each barrel; if it is in bulk, the manufacturer's certificate shall be produced and a copy given to each purchaser.

No fertilizer shall be sold or offered or exposed for sale unless a certificate of analysis and sample of the same shall have been transmitted to the Minister of Inland Revenue and the provisions of the foregoing sub-section have been complied with.

Every person who sells or offers or exposes for sale any fertilizer, in respect of which the provisions of this Act have not been complied with—or who permits a certificate of analysis to be attached to any package, bag or barrel of such fertilizer, or to be produced to the inspectors to accompany the bill of inspection of such inspector, stating that the fertilizer contains a larger percentage of the constituents mentioned in sub-section No. 11 of the Act than is contained therein—or who sells, offers or exposes for sale any fertilizer purporting to have been inspected, and which does not contain the percentage of constituents mentioned in the next preceding section—or who sells or offers or exposes for sale any fertilizer which does not contain the per-

centage of constituents mentioned in the manufacturer's certificate accompanying the same, shall be liable in each case to a penalty not exceeding fifty dollars for the first offence, and for each subsequent offence to a penalty not exceeding one hundred dollars. Provided always that deficiency of one per centum of the ammonia, or its equivalent of nitrogen, or of the phosphoric acid, claimed to be contained, shall not be considered as evidence of fraudulent intent.

The Act passed in the forty-seventh year of Her Majesty's reign, chaptered thirty-seven and entitled, "An Act to prevent fraud in the manufacture and sale of agricultural fertilizers," is by this Act repealed, except in regard to any offence committed against it or any prosecution or other act commenced and not concluded or completed, and any payment of money due in respect of any provision thereof.

A copy of the Act may be obtained upon application to the Department of Inland Revenue, as well as a copy of a Bulletin which it is proposed to issue in April, 1888, concerning the fertilizers

E. MIALI,
Commissioner.

January, 1889.

**NOTICE**

Is hereby given that all communications in respect to matters affecting the Department of Indian Affairs should be addressed to the Honorable E. Dewdney as Superintendent General of Indian Affairs, and not as Minister of the Interior, or to the undersigned. All Officers of the Department should address their official letters to the undersigned.

L. VANKOUGHNET,
Deputy Superintendent-General
of Indian Affairs.

Department of Indian Affairs, }
Ottawa, 11th May, 1889. }

**Intercolonial Railway**
OF CANADA.

The direct route between the West and all points on the St. Lawrence and Baie des Chaleur, Province of Quebec; also for New Brunswick, Nova Scotia, Prince Edward, Cape Breton and the Magdalene Islands, Newfoundland and St. Pierre.

EXPRESS TRAINS leave Montreal and Halifax daily (Sunday excepted) and run through without change between these points in 30 hours.

The Through Express Train cars of the Intercolonial Railway are brilliantly lighted by electricity and heated by steam from the locomotive.

New and Elegant Buffet Sleeping and Day Cars are run on all through Express Trains.

The popular Summer Sea Bathing and Fishing Resorts of Canada are along the Intercolonial, or are reached by that route.

CANADIAN EUROPEAN MAIL
AND PASSENGER ROUTE.

Passengers for Great Britain or the Continent by leaving Montreal on Thursday morning will join outward Mail Steamer at Rimouski the same evening.

The attention of shippers is directed to the superior facilities offered by this route for the transport of flour and general merchandise intended for the Eastern Provinces and Newfoundland; also for shipments of grain and produce intended for the European market.

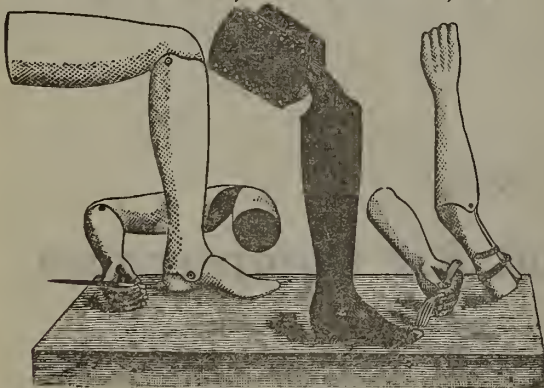
Tickets may be obtained and all information about the route, also Freight and Passenger rates, on application to

G. W. ROBINSON,
Eastern Freight and Passenger Agent,
137½ St. James St., MONTREAL.

E. KING,
27 Sparks Street,
OTTAWA.

D. POTTINGER,
Chief Superintendent.

Railway Offices, Moncton, N.B.
2nd July, 1889.

BEACOCK & CO., - - BROCKVILLE, ONT.

—Manufacturers of—

Rawhide, Artificial Limbs & Splints
Patented in the United States and Canada. Send for prices.

The Dispensary,

COR. BANK AND NEPEAN STREETS,
OTTAWA.

J. M. Musgrove, Chemist and Druggist,
PROP. ETOR.

Try Musgrove's Kidney and Liver Specifics,
only 50 cents per bottle.

**MONEY ORDERS.**

MONEY ORDERS may be obtained at any Money Order Office in Canada, payable in the Dominion; also in the United States, the United Kingdom, France, Germany, Italy, Belgium, Switzerland, Sweden, Norway, Denmark, the Netherlands, India, the Australian Colonies, and other countries and British Colonies generally.

On Money Orders payable within Canada the commission is as follows:

If not exceeding \$4.....	2c.
Over \$4, not exceeding \$10.....	5c.
" 10, " " 20.....	10c.
" 20, " " 40.....	20c.
" 40, " " 60.....	30c.
" 60, " " 80.....	40c.
" 80, " " 100.....	50c.

On Money Orders payable abroad the commission is:

If not exceeding \$10.....	10c.
Over \$10, not exceeding \$20.....	20c.
" 20, " " 30.....	30c.
" 30, " " 40.....	40c.
" 40, " " 50.....	50c.

For further information see OFFICIAL POSTAL GUIDE.

Post Office Department, Ottawa.
15th Sept., 1888.

GET
PHOTOS
TAKEN

— AT —

Pittaway & Jarvis'**117****Sparks St.**

Brodie states that he makes the sulphuric acid from the pure sulphur. He gets rid of the hydro-fluoric acid gas—which is produced by the action of the sulphur acid on the apatite—by a simple arrangement of wooden chimnies, thus solving a difficulty which has embarrassed many persons in their efforts to use Canadian phosphates. He makes a "complete fertilizer," that is, a mixture of the three principal ingredients of plant food, namely, phosphate, potash and ammonia. The demand is growing in a very encouraging manner, for when a farmer tries it once, he generally comes back for more. Mr. Brodie says he could sell many thousand tons during the coming year if he could make it, but the factory is small and the facilities not very great.

The advantages to the agricultural community in having such important enterprises as these is simply incalculable, for the farmer knows this important fact better than anyone—that the soils of the older settled provinces have become impoverished by years of cropping without replenishment, and districts that once yielded great stores of grain now only afford the scantiest pasturage or produce.

There is evidently a large and extending field in the Dominion of Canada for both the manufacture and use of fertilizers, which, if properly and judiciously nurtured, must tend to both profit and usefulness. As a well-known writer has said, "Our agricultural future must depend upon supplies of plant-food brought from sources outside the farm, and prepared for the farmer's use by those who make it their business to do so, and who must, in order to succeed, bring to it not only a large capital, but likewise science as a handmaid, skill and talent as absolute requisites. The progress of this industry measures the true progress of Canada, and promises results which it is impossible to foresee at this day. It opens up a wide vista of changes and improvements. It heralds the awakening of agricultural thought, and has partly awakened it. And with thinking comes improvement, comes better tillage of the soil, comes better stock, comes larger crops, better profits, and lastly, a higher moral and intellectual standard."

Exports of Canadian Phosphate.

The exports of Canadian phosphate from 1877 to 1888, as per official returns, may be stated to have been as follows:—

Year.	Tons.	Est'd value.
1877	2,823	\$ 47,084
1878	10,743	208,109
1879	8,446	122,035
1880	13,060	190,086
1881	11,968	218,456
1882	17,153	338,357
1883	19,716	427,668
1884	21,709	424,240
1885	28,969	496,293
1886	20,440	343,007
1887	23,690	319,815
1888	22,485	242,285

The exports for 1889 promise to exceed those of the last two years.

Parties having developed or undeveloped mineral lands for sale will find the REVIEW an admirable medium for bringing them before the notice of CAPITALISTS and INVESTORS in GREAT BRITAIN and the UNITED STATES.

On the Occurrence of Phosphates in Nature.*

D. G. M. Dawson, F. R. S., R. S. M. N.

In proposing to review, in so short a paper as this must necessarily be, a subject so extensive as that indicated by the title, a difficult task has been undertaken, and I cannot hope to do more than touch upon its main points.

In the first place it may be proper to enquire why phosphate materials are now so much sought for as fertilizers.

It has been said laconically that "Phosphorus is life," but this, like most bold generalizations, is but a partial, and even a misleading statement of the fact. Certain it is, however, that this element, variously combined, is present in all living tissues, whether vegetable or animal, and though in small quantity only, is absolutely essential to these tissues, and, therefore, to the manifestation of life. Animals, depending ultimately for their subsistence on plants, derive from these their supplies of phosphorus, together with the other substances necessary for their nutrition.

Unlike the animal, the plant is capable of living, ultimately, on inorganic substances, and while deriving a large part of its food from the air, is absolutely dependent on the soil for those incombustible constituents which, when the plant is burnt, remain as ash. Without these the growth of the plant is impossible, and it is therefore necessary to ensure a sufficient supply of them in the soil. Phosphorus, in a state of combination, is one of these, and that to which I wish particularly to refer.

In following this substance from the soil to the plant, from the plant to the animal, and from the animal again to the plant, we find a system of circulation which, under certain conditions might go on indefinitely. In a state of nature, this cycle is generally complete, but it is interfered with and broken by the present organization of humanity, and more particularly by those arrangements which have resulted in the massing of population in large towns.

In these it is found necessary to remove the effete and excrementitious matters by a system of sewage, which results in draining the phosphates and other substances valuable from an agricultural point of view, into the sea, where they may be considered as absolutely lost. Victor Hugo, in a well-known passage, contrasts the wealth to be seen rolling through the streets of Paris to that which is silently but steadily flowing away by the sewers beneath, which he maintains is greater. Be this as it may, in this particular case there is a continuous process on a large scale in action, by which the land is deprived of its phosphates, and particularly in a country like this, which exports great quantities of food material, with their contained phosphates, to be consumed abroad.

Some years ago (1869) Mr. Gordon Brown calculated the amount of phosphorus actually contained in grains annually shipped from the port of Montreal, estimating it for this purpose in the form of phosphoric acid. Wheat contains about $\frac{1}{10}$ (eight tenths) per cent. of phosphoric acid, or about 16 pounds to each ton, and as the total shipments of wheat amounted to 292,534 tons, the quantity of phosphoric acid sent away in it equalled 2,340 tons. Taking the average quantity of this substance contained in good soils, he found that this meant the total exhaustion to a depth of 12 inches, in so far as phosphates are concerned, of 70,320 acres, and would require the use of 5,850 tons of apatite

of good quality as manure to maintain the fertility of the fields. Adding to this the amount of phosphoric acid contained in other grains exported, he found the total loss in the year to be 2,574 tons of phosphoric acid, representing a value of over \$500,000.

With such statistics in evidence it will not be necessary to enlarge further on the necessity of discovering a source of supply of phosphates for our fields, and for this we must have recourse to some specially concentrated natural deposits. What, therefore, is the nature of these, how have they been found, and where do they occur?

In answering these questions, it must be remembered that soils have been produced by the decay and disintegration of rocks, and have derived their contained phosphates from the rocky crust of the earth.

Good soils contain say about $\frac{2}{10}$ (two-tenths) per cent. of phosphoric acid, and on analyzing rocks chemically or microscopically we find phosphates—generally calcic phosphate—present in them in similar small proportions. In some crystalline rocks we find apatite, or crystalline calcic phosphate so abundant that it can easily be recognized under the microscope. It is needless to say, however, that the percentage of phosphate present in ordinary rock masses is quite too small to suit them to be used as fertilizers for exhausted soils. We must have recourse to some richer sources of supply, and the concentration of phosphates in nature is generally found to have been brought about by organic agency. Of these concentrated deposits of phosphatic matter we may first glance at those known as Guanos. These are essentially composed of excrements of sea birds. Extensive accumulations of this character can occur only in dry climates, for though formed wherever sea birds congregate in great numbers, the rain fall is usually sufficient to remove them before they reach important dimensions. Guanos are naturally divided into two classes, though between the extremes of these there are many intermediate varieties.

These classes have been named respectively nitrogenous and phosphatic. Those of the first class occur in exceptionally dry climates, such as are found on the coast and adjacent islands of Peru, Bolivia and Chili, where rain seldom or never falls. In these the nitrogenous constituents of the organic matter—converted by decomposition into ammonia salts—remain as a part of the mass. In phosphate guanos, on the contrary, the rainfall has been sufficient to remove the whole or nearly the whole of the very soluble ammonia salts, while not enough to wash away the phosphatic material. Guanos of this class are of common occurrence in the West Indian Islands, and in some of these in which the subjacent coral rock is penetrated by caverns, only such part of the phosphatic accumulations are preserved as have been washed into these subterranean hollows through fissures, or have penetrated to them in solution through the porous coral rock.

In the Ardennes region of the south of France, phosphatic deposits occur which, in my opinion, are very similar in origin to those just alluded to. These, however, are very much older, and, in fact, include fossils of Tertiary age, and, so far as known, none of modern forms. They fill irregular cavernous fissures which traverse the surface of plateaus composed of Jurassic limestone, and it would appear that the higher parts of these plateaus have at one time formed an archipelago of bird-frequented islands in a Tertiary sea. The phosphate or phosphorite from these deposits is known commercially as

* Read before the Field Naturalists' Club, Ottawa

Bordeaux phosphate—from its place of shipment, —and though very irregular in its occurrence, is largely worked and exported.

Phosphatic deposits like these, however, directly referable to surface accumulations by sea-birds, are, as a rule, quite modern. With rare local exceptions, any which may have been found in the earlier geological periods have been washed away and lost; the very process of submersion, necessary as a preliminary step to the preservation by burial in the strata, causing their dissipation. Most of the truly fossil phosphates found in connection with the older rocks have been found in a quite different manner. To understand this we may examine first such modern deposits as the "mussel muds" of Prince Edward Island. These are accumulations produced in shallow tidal estuaries where great numbers of molluscs and other marine organisms are going to decay, so rich in phosphates and organic matters as to be of great value locally as a manure. Deposits more or less closely resembling these are found in many parts of the modern sea bottom and along the coast, and where just such deposits have been buried deeply, and included in some of the older formations, they produce what are known as "coprolite beds." This term, however, it must be explained, is in general very loosely applied. It should be restricted to the fossil excrements of various animals, which are occasionally found in the rocks, and often in such beds as those just referred to, but seldom even then constitute more than a small part of the phosphatic matter, most of which usually occurs as concretions or nodules. These have resulted from that slow process of drawing together of like particles in the mass, which is usually designated concretionary action, but is not in all cases fully understood. A fragment of shell or bone, or a tooth frequently serves as the nucleus of such a concretion, and when the material is abundant such concretions frequently coalesce and form almost continuous layers. The so-called *coprolite beds* of Cambridgeshire, Bedfordshire and other localities in England, and those of Carolina, in the Southern States are of this nature.

The last-named deposit dates no farther back than the Tertiary, and consists of a layer, usually from six to fifteen inches in thickness charged with nodules of calcic phosphate and containing also bones, teeth and shells, the pores of which have been more or less completely filled with the same material. This deposit lies at no great depth below the surface, and is still nearly horizontal. In some places it is below high-water mark, and large quantities of the phosphatic nodules are obtained by dredging in some of the estuaries and channels which penetrate the low alluvial country. Where the nodule-bed occurs above the sea-level it is worked by a system of trenching, the finer material being washed away on gratings, and the nodules then dried—generally by artificial heat—before being sent to the mill.

A long way farther back in time are the "Coprolite" beds of the south of England, which date in fact from the Cretaceous period. Where this deposit occurs at an inconsiderable depth below the surface, it is worked by a system of trenching similar to that employed in Carolina, the soil being carefully put to one side and subsequently restored, and the land again brought under tillage. As the deposits are thin it does not pay to follow them to any great depth, but some years ago the annual production was as much as 25,000 tons.

These can be considered only as instances of the mode of occurrence of phosphatic materials

in the geological series. Deposits more or less closely analogous, to those described and sufficiently rich to work are found in a number of other localities, which we have not now time to consider. There is reason to believe that phosphatic or "coprolitic" nodular deposits have been found wherever the local conditions were favourable and large quantities of animal matter were in process of accumulation and decay, throughout the entire geological series. Going a great way back in geological history, we find instances of this in Canada in parts of the Chazy subdivision of the Silurian, in the Graptolitic shales of the Quebec group, and even in the Cambrian rocks of St. John. It is true that none of these deposits are of importance from an economic point of view, for instances of workable deposits in these palæozoic rocks we must turn elsewhere.

They are merely mentioned here for the purpose of connecting the occurrence of naturally concentrated phosphatic materials as found in the newer rocks, with the deposits of the same material found in the oldest known rocks—those of the Laurentian period.

In the Laurentian rocks—which are those characterizing the great country to the north of the Ottawa, and elsewhere very largely developed in Canada—we have a great volume of sediments, deposited in an ocean of vast antiquity, the earliest in fact of which we find any traces. These sediments which, no doubt, originally resembled in their main features those of later ages, have since been so completely metamorphosed that their materials have entered into new combinations among themselves and become entirely crystalline. While, therefore, still consisting of the materials originally deposited, they resemble them as little in appearance as do the crude ingredients of glass the finished product. There can, however, be no doubt of the original sedimentary origin of these Laurentian rocks and the change from muds and sands—and I would also include contemporaneous volcanic materials—to wholly crystalline rocks such as these, is seen in less metamorphosed formations in various parts of the earth's crust, and has been traced in all its stages. If, therefore, ordinary limestones were originally present in these old rocks, we would expect them now to have assumed a wholly crystalline character, and to appear as marbles. Contained beds of a peaty or coaly nature might be expected to pass into crystalline carbon or graphite, and phosphatic nodular or coprolitic layers could appear only as crystalline calcic phosphate or apatite. As a matter of fact we find all three of these substances in the Laurentian, and though the proof may not be absolute that their origin and appearance was at first the same as that of analogous materials in the newer rocks, the evidence is all in that direction. The main facts in regard to the mode of occurrence of these deposits of apatite in Canada, so far as our knowledge goes, must be very briefly presented. Some of the beds in the Laurentian series are found to be comparatively rich in apatite, crystals and crystalline masses of this mineral being scattered through them. This is the case in some of the marbles, occasionally in the iron ores, and also particularly in connection with the pyroxenic rocks. In addition to these in which the apatite may be considered as generally distributed, certain layers, apparently of the character of beds, occur, consisting of nearly pure apatite, or containing so large a proportion of the minerals as to pay for working. Still further, we find distinct veins and fissures which have been filled with apatite by processes

of segregation in which the mineral is found either nearly pure, or more frequently, mingled with crystals of other substances.

Though the exportation of these Canadian deposits may, I believe, be considered as still in its infancy, it has already assumed considerable proportions. Quoting from an interesting paper read a few days ago by Dr. Sterry Hunt, before the American Institute of Mining Engineers, we find that the amount shipped from Montreal, in 1883, was 17,840 tons (see quantities exported in 1888 as quoted in another portion of this issue), of which a portion was delivered in Hamburg and Stockholm, but the greater part went to British ports. Of this amount, 15,000 were from Quebec, the remainder from Ontario. It is estimated, according to Dr. Hunt, that the shipments during the present year will amount to 24,000 tons.

Besides the very widespread distribution of these apatite deposits and their great economic importance, one of the most striking facts so far developed is their great irregularity. Taking into consideration the extremely disturbed character of the Laurentian rocks, this is easily understood. Layers and veins which may, before the great folding and kneading together of these rocks, have possessed considerable regularity and uniformity, have been, as a consequence of the excessive disturbance folded and dislocated in every sense, leading to the production of large pockets and irregular masses of apatite which may now be connected only by narrow and twisted seams, or may occupy what appear to be completely isolated positions.

This being the case, it may be asked, can a Geological Survey do anything to aid in the discovery of apatite and the development of this mining industry? Fortunately we are not quite without a clue in the matter. It has already been discovered (largely by Mr. Vernor's work) that certain broad zones of the Laurentian series (in part already traced out and mapped), contain most of the workable deposits of apatite, while extensive intervening belts of country show comparatively little apatite and offer little encouragement to the miner. These zones are pretty clearly recognizable by their composition and character, and though much has already been done in the matter of defining them, much more yet remains to do. They can, it would appear, be mapped down with a degree of certainty, nearly as great as regions capable of yielding good lumber, or lands suitable for farming can be defined by explorations with these particular ends in view. The further question involved in the utilization and working of special local deposits is also one requiring sagacity and special knowledge, but cannot be considered as within the province of a public survey. Like the enquiry as to how many feet of sawn lumber a given tree will afford, or how best to lay out a certain plot of a couple of hundred acres for farming purposes, this remains to be determined by the person who wishes to utilize these for his own pecuniary benefit.

Barnyard Manure.

Mr. Thomas Macfarlane, F.R.C.S., Dominion Analyst, again calls attention to the large amount of money which farmers pay for the ammonia in fertilizers, which might be saved if sufficient care was taken to preserve that contained in barnyard manure. Nearly the whole of the nitrogen in the fodder fed to farm stock is to be found in the excrements of the animals, and one-half of it is contained in the urine. It is further the fact that 95 per cent. of the

potash contained in the food of oxen and sheep may be recovered by carefully saving the liquid manure only. To secure the nitrogen, or ammonia, and the potash, the means are very simple. The dung from the different animals should be brought together and kept under cover at a lower level than the stable floor, so that the liquid manure may flow upon, over and down through it. In this way all the different sorts and both parts of the manure are properly blended, the solid part and the bedding kept moist, and none of the urine escapes. It is further necessary to strew the stable floor, below and behind the animals, with 2 lbs. per 1,000 lbs. live weight, daily, of ground plaster or sulphate of lime, which has the effect of retaining the ammonia resulting from the decomposition of the liquid, and the fermentation of the solid manure. It has recently been proposed to obtain these results by the use of superphosphates in place of ground plaster, and experiments by Heiden, Dietzell and others in that direction have been entirely successful. Dietzell mentions that 1½ lbs. of phosphoric acid only are required for the treatment of 1,000 lbs. of stable manure. The use of "plain superphosphate" in this way must result in the production of a manure of every excellent quality.



SEALED TENDERS addressed to the undersigned, and endorsed "Tender for Owen Sound Work," will be received until Wednesday, the 18th day of September next inclusively, for works for the improvement of the Harbour of Owen Sound, Grey County, Ontario, according to plans and a specification to be seen at the office of the Town Clerk, Owen Sound, and at the Department of Public Works, Ottawa.

Tenders will not be considered unless made on the form supplied and signed with the actual signatures of tenderers.

An accepted bank cheque, payable to the order of the Minister of Public Works, for the sum of three thousand dollars (\$3,000) must accompany each tender. This cheque will be forfeited if the party decline the contract, or fail to complete the work contracted for, and will be returned in case of non-acceptance of tender.

The Department does not bind itself to accept the lowest or any tender.

By order,

A. GOBIEL,
Secretary.

Department of Public Works,
Ottawa, 3rd Sept., 1889.

**JOHN SHEPHERD,
HOUSE DECORATOR,
Paper Hangings,**

WHOLESALE DEALER IN

Plate Glass Oils, Paints,
Dry Colors, Varnishes, &c.

Agents for the White Enamelled Letters and Numbers
all sizes.

ESTIMATES GIVEN

Agent for Spence & Sons' Stained Glass,
MONTREAL.

ALL ORDERS PROMPTLY ATTENDED TO.

225 & 227 Rideau St., and 176 George St.,
OTTAWA, ONT.

J. & R. CRAIG

= Tailors, =

105 SPARKS STREET

= Ottawa. =

F. BEBBINGTON,

(Bebbington & Hughes,)

Conveyancer & Exchange Broker

Money from \$50 to \$10,000

Advanced to farmers and others on Personal or
Real Estate Securities.

OFFICE :--70½ Sparks Street, - - - - Ottawa.



SEALED TENDERS addressed to the undersigned and addressed "Tender for Post Office, etc., Lachine, P.Q.," will be received at this office until Friday, 13th September, for the several works required for the erection of Post Office, etc., Lachine, P.Q.

Specifications can be seen at the Department of Public Works, Ottawa, and at the Corporation offices at Lachine, P.Q., on and after Friday, 23rd August, 1889, and tenders will not be considered unless made on form supplied and signed with actual signatures of tenderers.

An accepted bank cheque, payable to the order of the Minister of Public Works equal to five per cent. of amount of tender, must accompany each tender. This cheque will be forfeited if the party decline the contract, or fail to complete the work contracted for, and will be returned in case of non-acceptance of tender.

The Department does not bind itself to accept the lowest or any tender.

By order,

A. GOBEIL,
Secretary.

Department of Public Works,
Ottawa, August, 1889.

McKINLEY & NORTHWOOD
(Successors to Blyth & Kerr.)

56 & 58 RIDEAU STREET,

Hardware, Nails,

Carriage Wood Work, Axles, Springs,
Spades, Forks and Rakes.

**PLUMBING, GAS & STEAMFITTING
HOT AIR FURNACES.**

ALEX. RANKIN,

20 Toronto Street, Toronto Ont.

Agent for sale of Mines and Mineral Lands.

CORRESPONDENCE SOLICITED.

Agents in England and New York.

E. H. SARGENT & CO.,

IMPORTERS AND DEALERS IN

ASSAYER'S MATERIALS,

Chemicals and Laboratory Supplies.

125 State Street,

CHICAGO.

HARRIS & CAMPBELL

Latest Designs in Drawingroom, Diningroom
and Bedroom

FURNITURE

With improved Steam Machinery our facilities for
manufacturing Cabinet Goods are complete. Our upholstery
Department is well stocked with latest imported
patterns.

Corner **QUEEN & O'CONNOR Sts.**
OTTAWA.

THIS YEAR'S

MYRTLE

CUT AND PLUG

Smoking Tobacco

FINER THAN EVER.

SEE

T & B

In Bronze on Each Plug and Package.

**THE DOMINION
SAFETY BOILER CO.**

MANUFACTURERS OF

The "Field-Stirling" Patent High
Pressure Boiler,

The Safest and Cheapest Steam-Generator now in Use.

This Boiler is unusually durable, being made of the best steel
and wrought iron exclusively. No cast-iron is employed. It is
simple in construction, has a rapid, well-defined circulation, and a
large cool mud-drum, where all impurities are collected to be blown
off. All parts of the Boiler are readily accessible for the closest inspection.
It has great excess of strength and is not liable to be
strained by unequal expansion. The water space is divided into
sections so arranged that NO EXPLOSION IS POSSIBLE.

Some of Our Leading Customers:

The J. A. Converse Mfg. Co. (A. W. Morris & Bro.), Montreal;
The Canada Sugar Refining Co., Montreal; The Pillow and Hersey
Mfg., Montreal; The Berthier Beet Root Sugar Co., Berthier,
Que.; The Imperial Insurance Co., Montreal; The Massey Manufacturing
Co., Toronto; The Acadia Coal Co. (Ld.), Stellarton,
N.S.; Canada Paper Co., Windsor Mills, Que.; Royal Electric
Co. (Central Station), Montreal; Dodge Wood Split Pulley Co.
Toronto, and a repeat order from A. W. Morris & Bro., after five
months' experience; Ingersoll Rock Drill Co. of Canada.

We guarantee Dry Steam and Great Economy
of Fuel. Correspondence Solicited.

J. FRASER TORRANCE, M.E.,

P.O. Box 1707, Montreal.

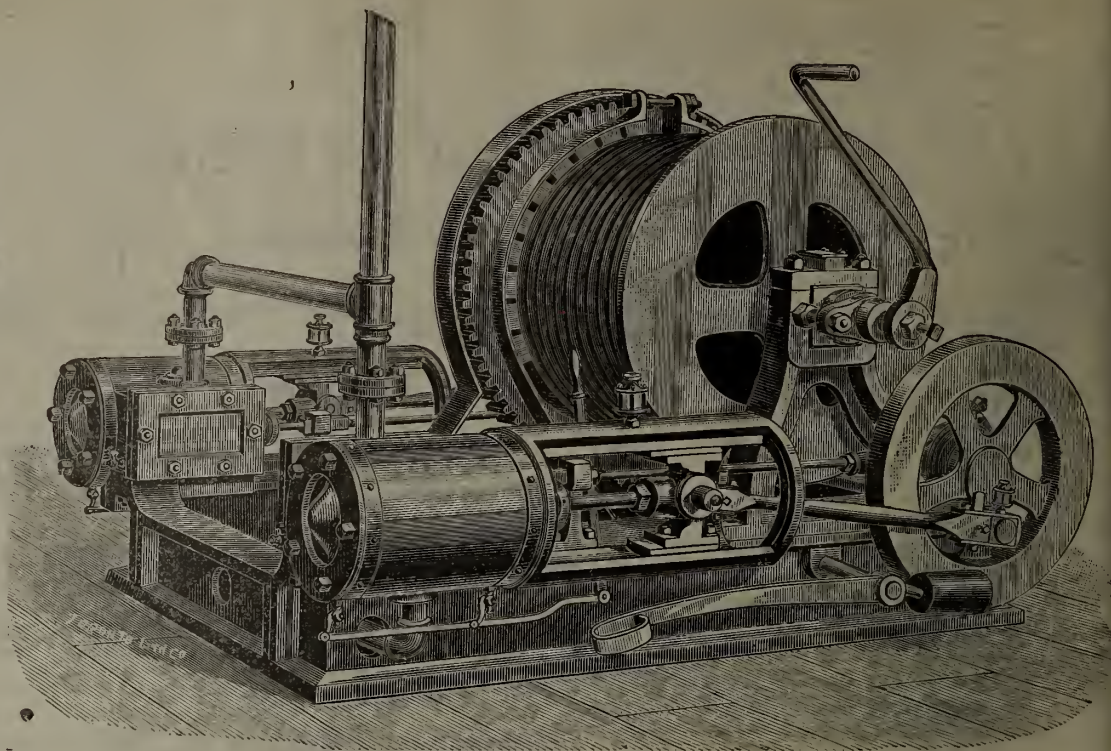
Manager

JOHN DOTY ENGINE CO.

Toronto, Ont.

MANUFACTURERS OF

Mining & General
Machinery.



HOISTING ENGINES

—: FOR :—

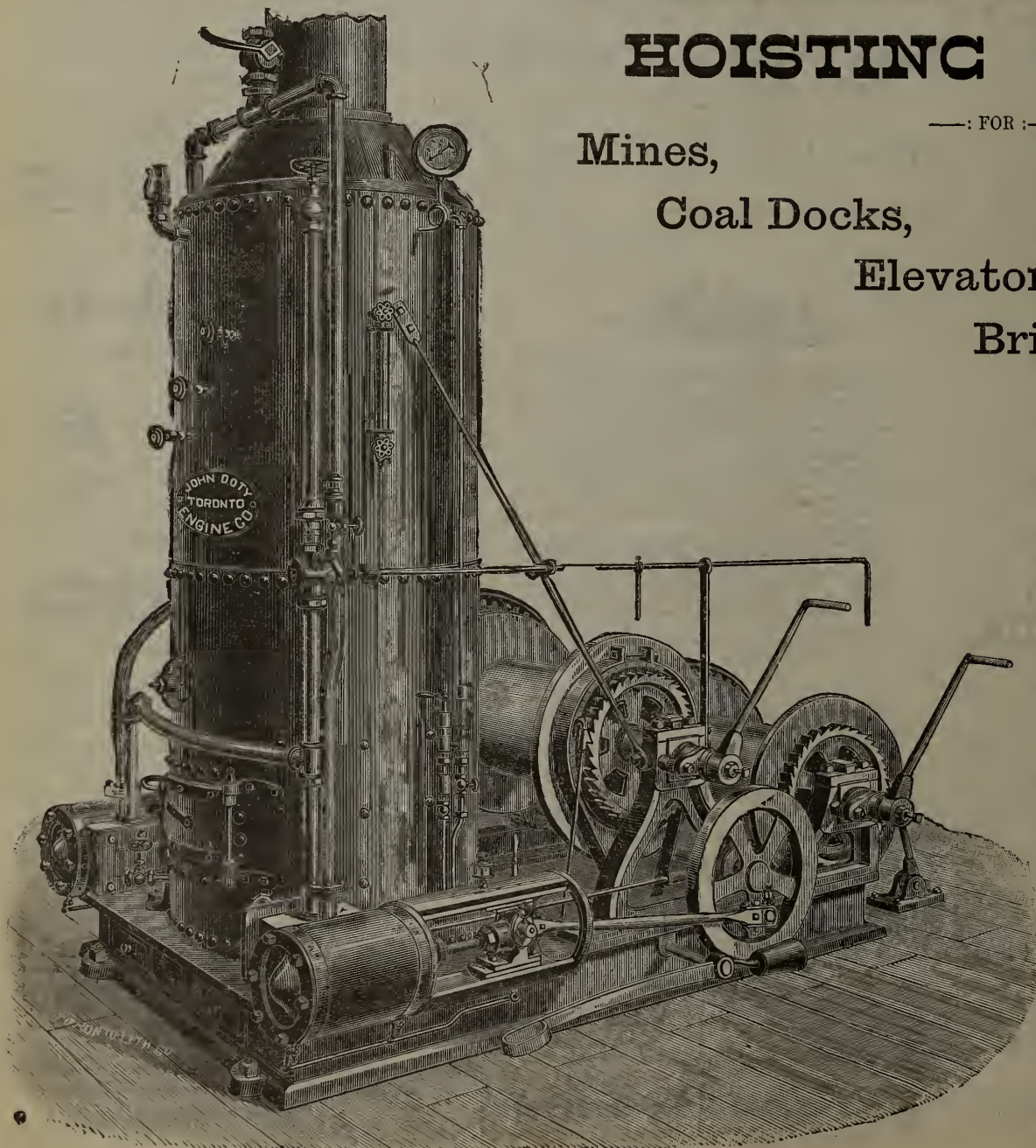
Mines,

Coal Docks,

Elevators,

Bridge Builders,

Contractors, &c.



CORLISS ENGINES

Tug & Steam Yacht Engines,

Mill Engines.

Shafting & Mill
Gearing.

All Descriptions of Boiler
and Tank Work.

Send for Estimates and
Catalogues.

FERTILIZERS.**G. H. NICHOLS & CO'S**

**"RELIANCE" Brand, a Complete Fertilizer
for all Crops, in 200 lb. Sacks.**

GUARANTEED ANALYSIS.

Ammonia (NH_3).....	2 per cent.
Available Phos. Acid (P_2O_5).....	6-7 " "
Potash (K_2O).....	2-3 " "

\$27.00 per ton at Works, Net Cash.

**"VICTOR" Brand, a Complete Fertilizer for all
Soils, in 200 lb. Sacks.**

GUARANTEED ANALYSIS.

Ammonia (NH_3).....	2-3 per cent.
Available Phos. Acid (P_2O_5).....	7-8 " "
Potash (K_2O).....	3-4 " "

\$30.00 per ton at Works, Net Cash.

SUPERPHOSPHATE (acidulated Can. Apatite) in bulk,
from \$10.00 per ton up, net cash, according to analysis. If
screened or bagged, \$2.50 per ton extra.

Farmers and others who wish to make their own mixtures,
can purchase Sulphuric Acid of us on favorable terms, or we
will compound for them any special formula at the lowest
possible cost. Correspondence solicited.

G. H. NICHOLS & CO.,

CAPELTON CHEMICAL WORKS,

CAPELTON, P.Q., CANADA.

The Simplest.

The Cheapest.

The Best.

BUY THE Household Fire Extinguisher

EVERY FARMER NEEDS ONE.

FENWICK & SCLATER,

THE MARKET PRICE

\$10.00

42 & 44 Foundling St.

MONTREAL.

COPPER NICKEL

PLATED.



Mining Regulations

TO GOVERN THE DISPOSAL OF

Mineral Lands other than Coal Lands, 1886.

THESE REGULATIONS shall be applicable to all Dominion Lands containing gold, silver cinnabar, lead, tin, copper, petroleum, iron or other mineral deposits of economic value, with the exception of coal.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein, either by surface or subterranean prospecting for mineral deposits, with a view to obtaining under the Regulations a mining location for the same but no mining location or mining claim shall be granted until the discovery of the vein, lode or deposit of mineral or metal within the limits of the location or claim.

QUARTZ MINING

A location for mining, except for iron on veins, lodes or ledges of quartz or other rock in place, shall not exceed forty acres in area. Its length shall not be more than three times its breadth and its surface boundary shall be four straight lines, the opposite sides of which shall be parallel, except where prior locations would prevent, in which case it may be of such a shape as may be approved of by the Superintendent of Mining.

Any person having discovered a mineral deposit may obtain a mining location therefor, in the manner set forth in the Regulations which provides for the character of the survey and the marks necessary to designate the location on the ground.

When the location has been marked conformably to the requirements of the Regulations, the claimant shall within sixty days thereafter, file with the local agent in the Dominion Land Office for the district in which the location is situated, a declaration or oath setting forth the circumstances of his discovery, and describing, as nearly as may be, the locality and dimensions of the claim marked out by him as aforesaid; and shall, along with such declaration, pay to the said agent an entry fee of FIVE DOLLARS. The agent's receipt for such fee will be the claimant's authority to enter into possession of the location applied for.

At any time before the expiration of FIVE years from the date of his obtaining the agent's receipt it shall be open to the claimant to purchase the location on filing with the local agent proof that he has expended not less than FIVE HUNDRED DOLLARS in actual mining operations on the same; but the claimant is required, before the expiration of each of the five years, to prove that he has performed not less than ONE HUNDRED DOLLARS' worth of labor during the year in the actual development of his claim, and at the same time obtain a renewal of his location receipt, for which he is required to pay a fee of FIVE DOLLARS.

The price to be paid for a mining location shall be at the rate of FIVE DOLLARS PER ACRE, cash, and the sum of FIFTY DOLLARS extra for the survey of the same.

No more than one mining location shall be granted to any individual claimant upon the same lode or vein.

IRON.

The Minister of the Interior may grant a location for the mining of iron, not exceeding 160 acres in area which shall be bounded by north and south and east and west lines astronomically, and its breadth shall equal its length. Provided that should any person making an application purporting to be for the purpose of

mining iron thus obtain, whether in good faith or fraudulently, possession of a valuable mineral deposit other than iron, his right in such deposit shall be restricted to the area prescribed by the Regulations for other minerals, and the rest of the location shall revert to the Crown for such disposition as the Minister may direct.

The regulations also provide for the manner in which land may be acquired for milling purposes, reduction works or other works incidental to mining operations.

Locations taken up prior to this date may, until the 1st of August, 1886, be re-marked and re-entered in conformity with the Regulations without payment of new fees in cases where no existing interests would thereby be prejudicially affected.

PLACER MINING.

The Regulations laid down in respect to quartz mining shall be applicable to placer mining as far as they relate to entries, entry fees, assignments, marking of localities, agents' receipts, and generally where they can be applied.

The nature and size of placer mining claims are provided for in the Regulations including bar, dry bench, creek or hill diggings, and the RIGHTS AND DUTIES OF MINERS are fully set forth.

The Regulations apply also to

BED-ROCK FLUMES, DRAINAGE OF MINES AND DITCHES.

The GENERAL PROVISIONS of the Regulations include the interpretation of expressions used therein; how disputes shall be heard and adjudicated upon; under what circumstances miners shall be entitled to absent themselves from their locations or diggings, etc., etc.

THE SCHEDULE OF MINING REGULATIONS

Contains the forms to be observed in the drawing up of all documents such as:— "Application and affidavit of discoverer of quartz mine." "Receipt for fee paid by applicant for mining location." "Receipt for fee on extension of time for purchase of a mining location." "Patent of a mining location." "Certificate of the assignment of a mining location." "Application for grant for placer mining and affidavit of applicant." "Grant for placer mining." "Certificate of the assignment of a placer mining claim." "Grant to a bed rock flume company." "Grant for drainage." "Grant of right to divert water and construct ditches."

Since the publication, in 1884, of the Mining Regulations to govern the disposal of Dominion Mineral Lands the same have been carefully and thoroughly revised with a view to ensure ample protection to the public interests, and at the same time to encourage the prospector and miner in order that the mineral resources may be made valuable by development.

COPIES OF THE REGULATIONS MAY BE OBTAINED UPON APPLICATION TO THE DEPARTMENT OF THE INTERIOR.

A. M. BURGESS,

Deputy Minister of the Interior.

MINING REVIEW

Canadian

Established 1882

Vol VIII.—No. 9.

1889.—OTTAWA, SEPTEMBER—1889.

Vol. VIII.—No. 9.

1889 CATALOGUE OF 200 PAGES, 1889

ROCK DRILLING AND AIR COMPRESSING,

This Catalogue is one of unusual interest and value.—*R.R. Gazette*.
Should be in the hands of every engineer and Contractor.—*Eng. and Min. Journal*.
Supplies a long felt want.—*Manufacturers Record*.
This is a thoroughly good publication. *Engineering News*.
A valuable addition to the literature on the subject.—*Eng and B'g Record*.
The matter is readily available.—*Tradesman*.
A Complete Work.—*Colliery Engineer*.
Handy for reference.—*Min. and Sc. Press*.
The Useful Information will be specially valuable.—*Eng. and B'g. Record*.
Is really a hand book.—*Am. Manufacturer*.

RAND DRILL CO.,

23 PARK PLACE, NEW YORK.

Hamilton Powder

COMPANY,

Manufacture Mining, Blasting, Military
and Sporting

Gunpowder,

DYNAMITE, DAULIN, and the new

ECLIPSE MINING POWDER

DOMINION AGENTS FOR

Safety Fuse, Electric Blasting
Apparatus, &c.

OFFICE

103 ST. FRANCOIS XAVIER STREET
MONTREAL.

BRANCH OFFICES & MAGAZINES
at all chief distributing points
in Canada.

CANADA ATLANTIC

RAILWAY.

THE SHORTEST PASSENGER ROUTE
BETWEEN

Ottawa and Montreal,

AND ALL POINTS EAST & SOUTH.

The only road in Canada running trains lighted
with electricity and heated by steam from the
engine. Luxurious Buffet Pullman Palace Cars
on all trains between Ottawa and Montreal. Only
line running through Sleeping Cars between

Ottawa, Boston and New York

And all New England and New York points.

Baggage checked to all points and passed by Cus-
toms in transit.

During season of navigation close connections
are made with Richelieu and Ontario Navigation
Company's Steamers at Coteau Landing, shooting
the St. Lawrence Rapids.

For Tickets, Time Tables and information apply
to nearest agent, or to

S. EBBS, City Passenger Agent,
24 Sparks St., OTTAWA.

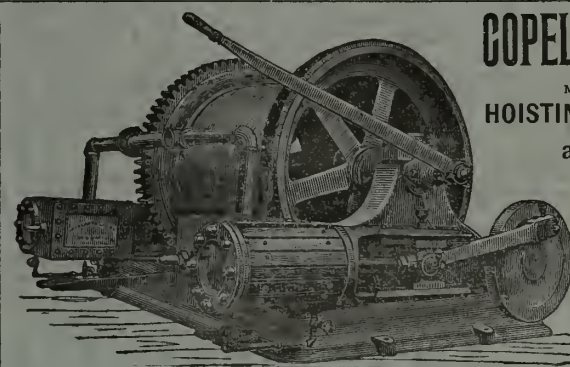
GEO. H. PHILLIPS, Gen. Agent,
VALLEYFIELD.

A. E. CAIRNS, General Agent,
136 St. James St., MONTREAL.

Or at 260 Washington St., Boston, and
317 Broadway, New York.

PERCY R. TODD,
General Passenger Agent.

E. J. CHAMBERLAN,
General Manager,
General Offices, Ottawa.



COPELAND & BACON

MANUFACTURERS OF
HOISTING ENGINES,
and MINING PLANTS.

85 Liberty St.

NEW YORK.

Send for Catalogue.

MILLER BROS. & MITCHELL

MANUFACTURERS OF

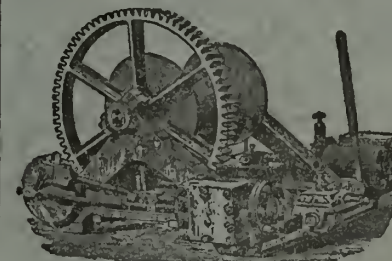
steam Rock Drills

AND

HOISTING ENGINES,

Mining & Contractors' Plant
&c., &c.

110 TO 120 KING STREET, MONTREAL, QUE.



THE

BELL TELEPHONE CO.

OF CANADA.

ANDREW ROBERTSON, . . . PRESIDENT

C. F. SISE, . . . VICE-PRESIDENT

C. P. SCLATER, . . . SECRETARY-TREASURER

HEAD OFFICE, . MONTREAL.

H. C. BAKER, Manager Ontario Department,
HAMILTON.

This Company will sell its instruments at prices
ranging from \$10 to \$25 per set. These instru-
ments are under the protection of the Company's
patents, and purchasers are therefore entirely free
from risk of litigation.

This Company will arrange to connect places
not having telegraphic facilities with the nearest
telegraph office, or it will build private lines for
firms or individuals, connecting their places of
business or residences. It is also prepared to
manufacture all kinds of electrical apparatus.

Full particulars can be obtained at the Com-
pany's offices as above, or at St. John, N.B., Hal-
ifax, N.S., Winnipeg, Man., Victoria, B.C.



MISS M. E. ORR.

REMINGTON

STANDARD

TYPEWRITER

Miss Orr, Championship
of the world and Gold Medal
at Toronto, 13th August,
1888.

GEORGE BENGOUGH,
GENERAL AGENT,
36 King Street, TORONTO.

ALEX. FLECK JUN.,

Manufacturer of every Description of

Mill Machinery

Water Wheels, Steam Engines,
Boilers, Derricks, Steam
Pumps and Mining
Machinery.

Brass and Iron Casting of every
Description.

**VULCAN IRON WORKS, WELLINGTON ST.
OTTAWA.**

**DYNAMO ELECTRIC
MACHINES and LAMPS**



THE
BALL ELECTRIC LIGHT CO. LD.
MANUFACTURERS OF

ELECTRIC LIGHTING APPARATUS.

57, ADÉLAÏDE ST. W.

**TORONTO
ONT.**

ARC and INCANDESCENT

FOR MINING PURPOSES

BLACK DIAMOND STEEL
TRADE MARK

Park, Brother & Co. Lim

PITTSBURGH, PA.

BLACK DIAMOND STEEL WORKS

— AND —

Lake Superior Copper Mills.

CANADIAN BRANCH WAREHOUSE:

377 St. Paul St. MONTREAL

New York Belting & Packing Co.

15 PARK ROW, NEW YORK

JOHN H. CHEEVER, Treasurer.

J. D. CHEEVER, Dep'y Treasurer.

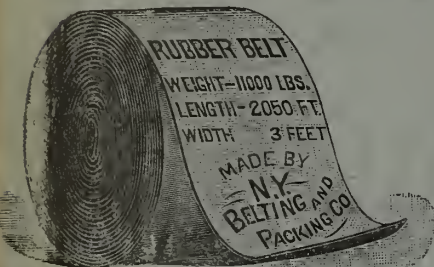
Oldest and largest Manufacturers in the United States of

VULCANIZED RUBBER FABRICS

FOR MECHANICAL PURPOSES.

EXTRA RUBBER BELTING AND HOSE

FOR MINING PURPOSES.



RUBBER BELTING.

CIRCULAR WOVEN SEAMLESS, ANTI-SEPTIC RUBBER LINED

"CABLE" HOSE AND TEST HOSE

For the use of Steam Engines, Force Pumps, Rolling Mills, Iron Works, Factories, etc. Woven in a superior manner to insure wear, compactness and durability.



"TEST HOSE."



Emery Vulcanite Wheel.

SOLID VULCANITE EMERY WHEELS

(Large Wheels made on iron centers)

Cuts Cooler and Freer than any other other wheel in the market.

SALESROOMS:—Chicago, 151 Lake St.; Detroit, 16-24 Woodward Ave.; Boston, 52 Summer St.; Cleveland, 176 Superior St.
European Branch: Pickhuben, 5, Hamburg (Freihafengebeit), Germany.

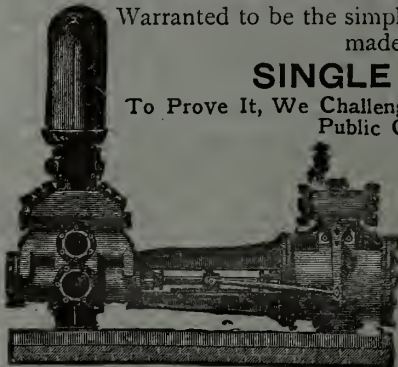
The M. T. DAVIDSON

IMPROVED MINING PUMP.

Warranted to be the simplest and most efficient Steam Pump made, whether it be

SINGLE OR DUPLEX.

To Prove It, We Challenge All Makers of Steam Pumps to a Public Competitive Test.



COMPOUND PUMPING ENGINES,

Obtaining a higher duty than any direct-acting pump made.

MANUFACTURED BY THE

Davidson Steam Pump
COMPANY,

New York Office, - - - 77 Liberty Street.

ROOT'S

SPIRAL RIVETED PIPE

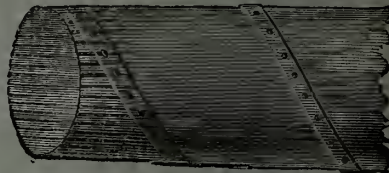
FOR

Hydraulic Mining,

Water Works

Ranch and Railroad

Water Supplies.



From 2 to 24 inches in diameter and 1 to 25 in length. Manufactured with fittings to suit, capable of withstanding any desired pressure.

ABENDROTH & ROOT MFG. CO.

28 Cliff Street, New York.

Chicago Branch, - - SMITH & KNAPP, 62 South Canal Street.

LIDGERWOOD MANUF'G CO.

96 LIBERTY ST, NEW YORK,

34 & 36 WEST MONROE ST. CHICAGO, 197 TO 203 CONGRESS ST. BOSTON,

Largest Manufacturers in the United States of Hoisting Machinery of Every Description for Mines, Tunnel Work, Contractors, and General Hoisting Purposes.

IMPROVED HOISTING ENGINES

FOR MINING PURPOSES A SPECIALTY.

Over 5,000 Engines in Use!

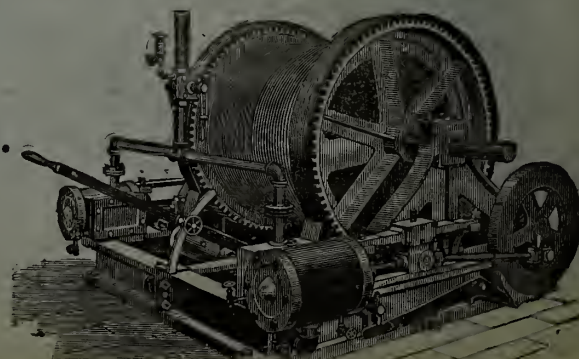
300 Styles

and Sizes.

Send for
CATALOGUE.



FRICION DRUM PORTABLE HOISTING ENGINE.



Double Cylinder Reversible Mine Engine.

F. G. BECKETT ENGINE CO.

HAMILTON, ONT.



Having had many years practical experience in the manufacture of

MINING MACHINERY

IS NOW PREPARED TO CONTRACT FOR

Stamp Mill Machinery,
Concentration Mills,
Revolving, Roasting and
Drying Furnaces.
Rock Breakers,
Cornish Rolls for crushing,
Amalgamating Pans and Settlers,
Concentrators and
Revolving Screens,
Smelting Furnaces, Retorts,

HOISTING ENGINES,

EITHER GEARED OR DIRECT ACTION.

Cornish Pumping Machinery,
Iron Ore Cars, Safety Cages, &c.,
Rock Drills and Air Compressors.

STEAM ENGINES AND BOILERS.

Marine Engines and Steam Yachts.

Francis D. Taylor
MINING ENGINEER,
BROCKVILLE, - ONTARIO

SPECIALTY. — The Mining of Iron Ores, Coals, and the Manufacture of Iron and Steel.

Mr. T. has had for many years the management of large mining enterprises in England and the U. S. A.

CAMERON STEAM PUMP
SIMPLE, RELIABLE, COMPACT, DURABLE.
NO OUTSIDE VALVE GEAR.
THE A. S. CAMERON STEAM PUMP WORKS.
ADAPTED FOR ALL PURPOSES.
FOOT OF EAST 23rd STREET, NEW YORK.



DOMINION ASSAY OFFICE AND MINING BUREAU.

Prospecting, Surveying and Examinations by Experts. Mining properties purchased or floated on the European markets; Capital found for developing same. Interest in good mining property secured.

London Office: 21 Richmond St. E. } TORONTO
33 King St., Cheapside. 44 Victoria St.

**TAYLOR McVEITY,
Barrister, Solicitor, &c.,**

Supreme Court and Departmental Agent,
SCOTTISH ONTARIO CHAMBERS, OTTAWA.

WM. HAMILTON MERRITT, F.C.S.

Associate Royal School of Mines, &c.,
Mining Engineer and Metallurgist,
Will report on Mines and Mineral Properties.

ADDRESS:
15 TORONTO ST., TORONTO, ONT.

J. T. DONALD, M.A.,

Analytical Chemist and Assayer,
124 St. JAMES St. - MONTREAL
Analyses and Assays of every description. Manufacturing processes practically tested. Laboratory instruction in Chemistry, Assaying and Mineralogy. Terms on application.

**THE DOMINION
Leather Board Co.**

MONTREAL,

— MANUFACTURERS OF —

Leather Board & Stiffeners

ALSO OF

ASBESTOS MILL BOARD,

STEAM PACKING, and

FRICTION PULLEY BOARD.

Samples and prices furnished upon application.
Please mention this paper.



ONTARIO

Mining Regulations.

The following summary of the principal provisions of the General Mining Act of the Province of Ontario is published for the information of those interested in mining matters in the Algoma District, and that part of the Nipissing District north of the Mattawan River, Lake Nipissing and French River.

Any person or persons may explore for mines or minerals on any Crown Lands surveyed or unsurveyed, not marked or staked out or occupied.

The price of all lands sold as mining locations or as lots in surveyed townships is two dollars per acre cash, the pine timber being reserved to the Crown. Patentees or those claiming under them may cut and use such trees as may be necessary for building, fencing or fuel, or for any other purpose essential to the working of mines.

Mining locations in unsurveyed territory shall be rectangular in shape, and the bearings of the outlines thereof shall be due north and south, and due east and west astronomically, and such locations shall be one of the following dimensions, viz: eighty chains in length by forty chains in width, containing 320 acres, or forty chains square, containing 160 acres, or forty chains in length by twenty chains in width, containing 80 acres.

All such locations must be surveyed by a Provincial Land Surveyor, and be connected with some known point or boundary at the cost of the applicant, who must file with application surveyor's plan, field notes and description of location applied for.

In all patents for mining locations a reservation of five per cent. of the acreage is made for roads.

Lands patented under the Mining Act are free from all royalties or duties in respect to any ores or minerals thereon, and no reservation or exception of any mineral is made in the patents.

Lands situated south of the Mattawan River, Lake Nipissing and French River are sold under the Mining Act at one dollar per acre cash.

Affidavits showing no adverse occupation, improvement or claim should accompany applications to purchase.

A. S. HARDY,

Commissioner

Department of Crown Lands, Toronto.

The Canada Co.

Will issue Licences to Prospect or to work Minerals on any of their Mining Lands and Mineral Reservations,

Covering nearly a

Quarter of a Million Acres

In Eastern Ontario, and principally within the belts containing

Iron, Phosphate, Gold, Galena Plumbago, Mica, Marbles, Building Stone, and other valuable Minerals.

For list of lands and terms apply to the Company's Mining Inspectors,

H. T. STRICKLAND,
Peterborough, Ont.,

For lands in the County of Hastings and westward, and to

ANDREW BELL, P.L.S.,
Almonte, Ont.,

For lands East of the County of Hastings.

TO MINERS AND OTHERS.

Bannerman & Powers,

VULCAN BOILER WORKS.

428 and 340 Wellington St., Ottawa.

MANUFACTURERS OF

IRON AND STEEL BOILERS

OF EVERY DESCRIPTION.

Tanks, Girders, Iron Roofing, Bank Vaults, Smoke Stacks

—AND ALL KINDS OF—

SHEET IRON WORK.

Repairs Neatly and Promptly Executed

FENWICK & SCLATER,

Manufacturers of Asbestos, Fire Hose, Files and Cotton Waste, Miners of Asbestos and Soapstone,

ASBESTOS

Cotton, Leather and Rubber Belting,

42, 44 & 46 Foundling Street, Montreal.

H. R. IVES & CO.,

Hardware Manufacturers and Founders,
QUEEN ST., MONTREAL.

STOVES. TRADE MARK "Buffalo" — IRON BEDSTEADS FOR MINERS' USE.	PORTABLE FORGES. — BLACKSMITH'S DRILLS.	MONTREAL SMELTING CO'S BABBIT METAL.	CASTINGS Of every description to order. — SOIL PIPE.
---	---	---	---

PORTABLE ENGINES AND SAW-MILLS

Of all capacities—from 3000 feet of lumber and up per day.

Saw-Mills.

Shingle-Mills.

Lath-Mills.

Chopping-Mills.

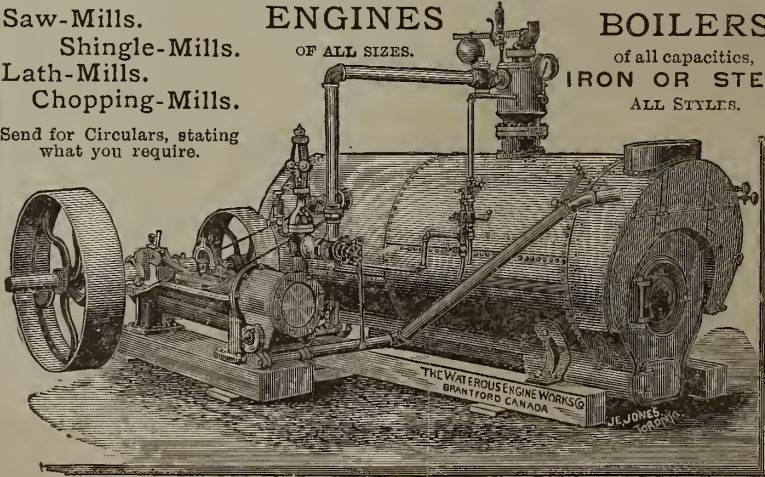
ENGINES

OF ALL SIZES.

BOILERS

of all capacities,
IRON OR STEEL,
ALL STYLES.

Send for Circulars, stating what you require.



Waterous Engine Works Co. Brantford, Canada.
St. Paul, Minn., U.S.A.

JOHN E. HARDMAN, S.B.
MINING ENGINEER,
OLDHAM, NOVA SCOTIA.

Can be consulted on all matters pertaining to the profession.

The development and management of Gold Properties a specialty.

WILSON & GREEN,
Commission Merchants,
PHOSPHATE SHIPPERS.
AGENTS HIGH ROCK MINE.

30 St. François Xavier St., - MONTREAL.

EDMUND SPARGO,
 Consulting and Mining Engineer, 3 Cable Street,
 Liverpool.

Owners of or Investors in Metalliferous Mines, Slate, Granite, and other Stone Quarries, Brick, Terra Cotta, Fire and other Clays and Mineral Estates in general, requiring reliable and sound advice either in the Purchase or Disposal thereof, should consult E.S., who has executed important professional Commissions in Germany, Austria, Hungary, France, Belgium, Spain, Portugal, Sweden, Norway, and in the various Mining Districts throughout Great Britain and Ireland. Telegraphic Address: "Spargo," Liverpool. Bankers, National Provincial Bank of England, Liverpool.

THOMAS HEYS,
Analytical and Consulting Chemist and Assayer.

References are kindly permitted by the following:
 Messrs. Gooderham & Worts, Toronto, Limited; Messrs. P. R. Lamb & Co.; John Livingston, Esq., Dominion Bolt Co.
 Assay and Analytical Laboratory } TORONTO.
 16 King St. West, opposite the Rossin House, }

J. LAINSON WILLS,
F. C. S., ETC.

Late Manager Canadian Phosphate Co. (Lim.),

Reports upon Mines and Mining properties.
 Advice given on Chemical and Metallurgical processes.

SPECIALTIES: PHOSPHATE AND GOLD.

TELEGRAPHIC OR POSTAL ADDRESS:

WILLS, BUCKINGHAM, P.Q.

Irwin, Hopper & Co.
MINERS AND SHIPPERS OF
MINERALS,

30 St. François Xavier Street,
MONTREAL, CAN.

Asbestos, crude and manufactured. Phosphate, Mica,
 Plumbago, Soapstone, &c.

JOHN D. FROSSARD, B.S., M.E.
MINING ENGINEER & GEOLOGIST,

30 St. François Xavier St., - - Montreal.

Specialty—Phosphate Lands.

JAMES HOPE & CO.
BOOKSELLERS,
Stationers, Bookbinders and Printers,
OTTAWA.

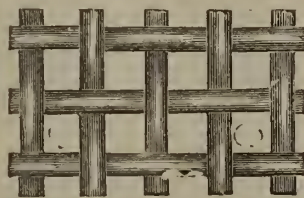
SPEIGHT & VanNOSTRAND,
Dominion and Provincial Land Surveyors,
Draughtsmen, Valuers, &c.
OFFICE: ROOM "J," FIRST FLOOR, TORONTO ARCADE,
YONGE ST., TORONTO.
 Surveys, Plans, Descriptions of Properties, etc., promptly executed.
 Timber Limits and Mining Claims Located.

MILLAR & CO.
General Merchants & Shipping Agents
ATLANTIC CHAMBERS,
209 COMMISSIONER ST., - MONTREAL
 Cable address, "Hoyer, Montreal." P.O. Box 1095.

AGENT FOR The Canadian Phosphate Co., Ltd., of London, Eng.,
 The Montreal Union Abattoir Co., of Montreal, Can.
 English Correspondents Messrs. Couper, Millar & Co., London, England.



For Mining Hoisting Derricks, etc.



Strong Wire Cloth and Screens
 For Mining, etc., manufactured by
The B. Greening Wire Co., Ltd.
HAMILTON, ONT.

NATIONAL COLONIZATION
Lottery!

UNDER THE PATRONAGE OF
THE REV. FATHER LABELLE.

Established in 1884 under the Act of Quebec, 31 Vict., Chap. 36, for the benefit of the Diocesan Societies of Colonization of the Province of Quebec.

CLASS D.

DRAWINGS ON THIRD WEDNESDAY IN EVERY MONTH AT 2 P.M.

Prizes value \$50,000

Capital Prize: 1 Real Estate worth \$5,000.

LIST OF PRIZES.

1 Real Estate worth	\$5,000	\$5,000
1 Real Estate worth	2,000	2,000
1 Real Estate worth	1,000	1,000
4 Real Estates	500	2,000
10 Real Estates	300	3,000
30 Furniture Sets	200	6,000
60 Furniture Sets	100	6,000
200 Gold Watches	50	10,000
1000 Silver Watches	10	10,000
1000 Toilet Sets	5	5,000

2307 Prizes worth \$50,000

Tickets, \$1.00!

Offers are made to all winners to pay their prizes cash, less a commission of 10 p. c. Winners' names not published unless specially authorized.

S. E. LEFEBVRE, Secretary
 Office: 19 St. James St., Montreal, Can.

W. Blakemore, F.G.S., M.E.,
 Member of I. & S.I.

A. Montgomery Evans, M.E.
 of Canada & U.S.

BLAKEMORE & EVANS,
MINING & CIVIL ENGINEERS
Exchange Buildings, Cardiff, S.W.

LONDON OFFICE:

Robert H. Jones, 82 Queen St., Cheapside, London, E.C.

Reports, Estimates, and Valuations made on Iron and Steel Works
 Blast Furnaces, and all classes of Mining Properties.

CANADIAN BUSINESS PROMPTLY ATTENDED TO.

To Prevent Boiler Explosions

And other accidents to steam boilers, and to secure economy in working, insure with

THE BOILER INSPECTION
AND INSURANCE COMPANY OF CANADA.

Sir Alex. Campbell, K.C.M.G., | John L. Blaikie, Esq.
 President. Vice-Pres.

HEAD OFFICE: - - - - - **TORONTO**
 G. C. ROBE, Chief Engineer.

A. FRASER, Sec'y-Treas.

ORFORD COPPER CO.,
COPPER SMELTERS.

Works at Constable's Hook, N.J., opposite new Brighton, Staten Island. Copper Ore, Mattes, or Bullion purchased. Advances made on consignments for refining and sale. Specialty made of Silver-Bearing Ores and Mattes.

SELL

INGOT AND CAKE COPPER.

President, **ROBERT M. THOMPSON,**

Treasurer, **G. A. LAND.**

Office, 37 to 39 Wall Street, New York.

Robin & Sadler,
MANUFACTURERS OF
LEATHER BELTING.

TRY OUR

Waterproof Belting,
 Just the thing for Mining Machinery.

MONTREAL, **TORONTO,**
 2518, 2520, 2522 Notre Dame St. 129 Bay Street.

Diamonds, Jewelry, Watches & Silverware
AT ROSENTHAL'S
Goldsmith's Hall, 87 Sparks St.
OTTAWA.

T. D. LEDYARD,
DEALER IN MINERAL LANDS
4 ONTARIO CHAMBERS, TORONTO.

Will buy undeveloped iron ore and other mineral properties.
 WANTED. — Deposits of Magnetic Iron Ore, Red Hematite, Brown Hematite, Galena, Iron and Copper Pyrites, Mica, Soapstone, Marble, Gypsum, Baryta. Samples can be sent by Sample Post for 1 cent for 4 oz. or up to 24 oz. in weight.
 Information regarding mines cheerfully given. Correspondence solicited. Crown Land Business attended to.

MACDONALD & CO., Limited,

—MANUFACTURERS AND DEALERS IN—

PUMPING MACHINERY, IRON PIPES, FITTINGS, &c., FOR MINERS' USE.

Call or Write us for Prices.

HALIFAX, N.S.

DODGE PATENT

Wood Separable Split Pulleys

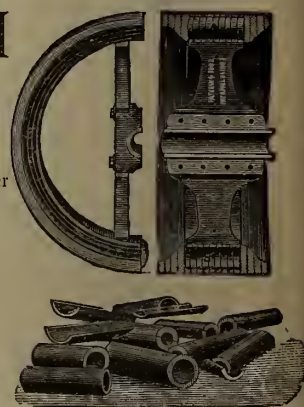
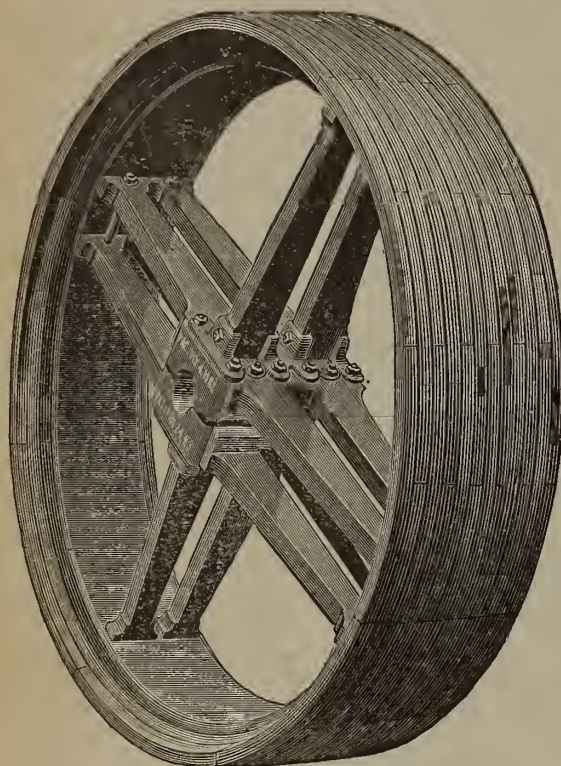
Best Belt Surface, Lightest, Strongest, Best Balanced and Most Convenient Pulley in the World.

WITH OUR PATENT BUSHING SYSTEM

In Comparing Prices of Pulleys please note carefully the following:

1. Our list is lower than most others.
2. Every Pulley is a Split Pulley.
3. Every Pulley is guaranteed to transmit from 25 to 60 per cent. more power than an iron one with same tension of belt.
4. Our Pulleys are 70 per cent. lighter than iron pulleys.
5. The fastening does not mar the shaft.
6. They are perfect in Balance.
7. They can be used on many different sizes of shafting.
8. They are the most thoroughly made wooden pulleys in the world.
9. And the handsomest pulley on the shaft.
10. No chances to take. Every pulley as represented or no sale.

Order a Sample Pulley, after which you will have no other.



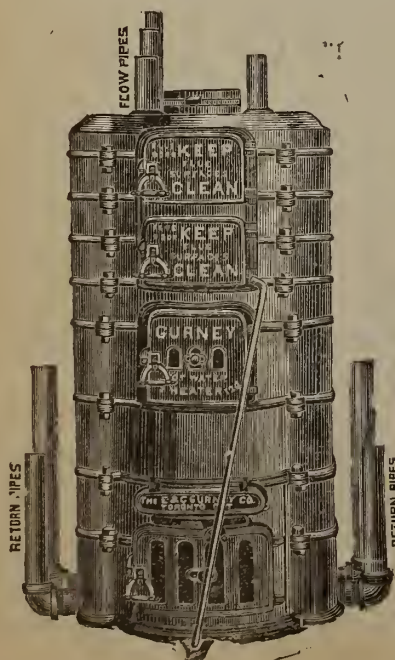
EVERY PULLEY IS A SPLIT PULLEY
Made in any size from 9 inches to 16 ft. diameter
with original bores of 3 and 3½ inches,
bushings to be used for intermediate sizes;
larger ones bored to order.

WE ALSO MANUFACTURE
WOODEN GROOVED PULLEYS FOR THE TRANSMISSION OF POWER
BY MANILLA ROPE,

Under the Dodge Patent System from 5 to 500 h. p. State power to be transmitted, speed of shafts, relative position of shafts, distance between shafts, and we can furnish a clear estimate.

EVERY PULLEY WILL FIT.
22 or more sizes of Shafting.
200 of our Pulleys and an assortment of bushings represent as many as 4,000 iron pulleys, a great advantage to dealers carrying stock.

Apply for particulars to THE DODGE WOOD SPLIT PULLEY CO., TORONTO.



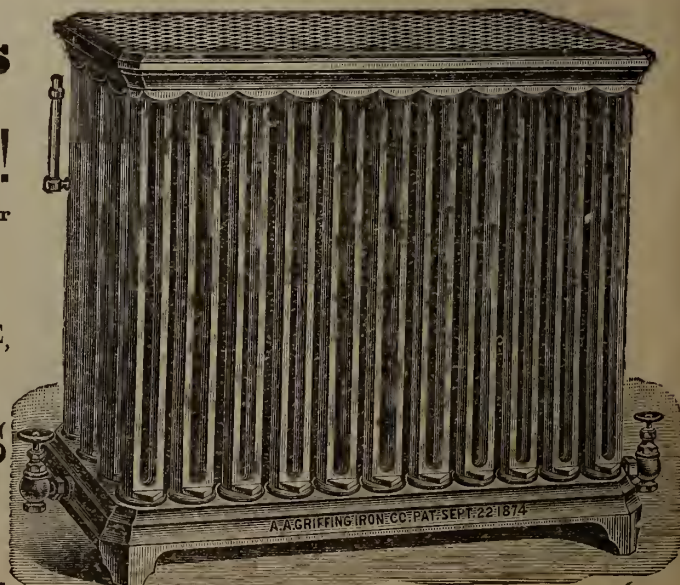
USE GURNEY'S IMPROVED CELEBRATED Hot Water Heaters!

Guaranteed more Economical than any other
Heater now made, and containing every
known Improvement in Hot
Water Heating.

STEAM FITTINGS, CAST IRON PIPE,
REGISTER, GRATES, ETC.

HOT AIR FURNACES
FOR COAL OR WOOD

E. & C. GURNEY & CO.,
MONTREAL.



Bundy Radiators for Quick Circulation and Economy of Space,

CHEMICAL APPARATUS! OF EVERY DESCRIPTION.



Glass, Porcelain, Stoneware, Platinum Crucibles of every sort, Analytical Scales and Weights, Fine Chemicals and Reagents, including Volumetric Solutions. Every requisite for Analysis or Experiment. For Sale by

LYMAN, SONS & CO.,
384 St. Paul St., Montreal.

Illustrated Catalogue mailed on receipt of 10c. or Business Card.

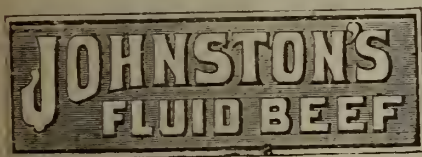
Boiler For Sale.

AN EIGHTY H.P. TUBULAR STEEL BOILER made by W. C. White, Montreal, 15 ft. x 5 ft. 4 in. eighty 3½ in. tubes; smoke stack 45 ft. long; guylards and guys. Very little used. Equal to new. Price on cars, \$600. Address

P. O. Box 6,
MONTREAL.

A WANT.

A Food that contains the greatest amount of nourishment in the smallest possible bulk, that can be relished, easily digested, and that will QUICKLY NOURISH AND STRENGTHEN. This want is fully supplied by



It contains more concentrated nourishment than any other preparation. The NUTRITIOUS ELEMENTS being in a partially digested form, it can be retained and thoroughly assimilated by the weakest stomach, and it cannot fail to permanently benefit.

Victor Electric Fuses.

Superior to all others for Exploding any make of Dynamite, High Explosives, or Gelatine Powder. Each Fuse is tested and warranted extra strong and waterproof. Low grades of Dynamite Powder will do ten per cent. more execution if detonated with Victor Electric Fuses.

VICTOR BLASTING MACHINES.

Latest improvements, made in three sizes, easy to operate, strong and durable. No expensive repairs, low in price, will fire any make of Electric Fuses.

MANUFACTURED ONLY BY

JAMES MACBETH & CO.,

128 Maiden Lane, N.Y., U.S.A.

Send for Catalogue.

FOR SALE.

A COAL MINE IN CAPE BRETON,

Area, 970 acres, underlaid by 6 or 7 beds of the best Coal in Nova Scotia. The property is estimated to contain from 50 to 60 million tons of Coal. No Coal Mine can be more easily or cheaply operated. The angle of dip is 6 degrees, and the rock stratification is remarkably even and without fault or break.

Apply to

ALEXANDER CAMPBELL,
Annapolis Royal, N.S.

EDMUND C. SHOREY, M.A.,

Analytical Chemist,

FOOT OF PRINCESS STREET } - - KINGSTON.

MINERALS OF ALL KINDS assayed at reasonable rates. Analyses of Milk, Water, &c.

PHOSPHATES A SPECIALTY.

D. McEWEN & SON,

Machine, Engine & Boiler Works

(Established January, 1868)

Compound and Yacht Engines a Specialty. Estimates for Steamboats complete.

MINING REPAIRS CONSTANTLY ON HAND.

*WORKS AND OFFICE:

54 to 60 Queen Street, Kingston, Ont.

ASBESTOS.

THEO. HAMEL,

44 Mountain Hill, Quebec,

SOLE ASBESTOS MANUFACTURER in CANADA

Write for prices and catalogue. Use Asbestos and save your money. Applied on boilers and Steam pipes it will prevent them from rusting and will economize 33% on fuel.

Fire-Bricks of Clay and Asbestos.—

A process has been patented in Germany for making fire-bricks by compressing in moulds an intimate mixture of 75 per cent. of asbestos and 25 per cent. of plastic refractory clay.

Rock Drills.—In a paper read by the Ritter von Rziha before the Austrian Society of Engineers and Architects, the various kinds of rock-drills are discussed. The author gives a detailed list of treatises in which descriptions of the various kinds of rock-drills have appeared. A number of the best known percussion machines are mentioned by the author, who observes that in Austria the Schram and the Ferroux drills are best known, whilst in Germany those of Frolich, Meyer, Jagar, and Schram are most frequently employed. The only important type of drills other than percussion ones is that of Brandt, which is just as frequently in use in Europe as is the percussion type, and hitherto both have been employed with almost equal success. In the Mansfeld district, both Brandt and Frolich drills have been employed for similar work, and for an equal amount of work done the cost has been about the same in both cases. The Brandt drills are preferable in cases where much water is met with, such as in sinking deep shafts and in cases where less power is available, since the power required for Brandt drills is only about 4-7 of that required for the Frolich percussion drill. Percussion drills are the most useful in long tunnels up to about 10,000 feet in length, where the compressed air escaping from the drill produces a sufficient ventilation. There are, the author states, four firms in Germany that undertake the driving of tunnels by rock-drills. They guarantee a progress of from 10 ft. to 11½ ft. a day in levels having a diameter of from 54 to 59 square feet, at a price of from £3 10s. to £4 12s. per foot, they providing the machinery; or at the rate of £1 10s. to £2 5s., if the necessary drills, etc., are found by the mine.

ALEX. RANKIN,

20 Toronto Street, Toronto Ont.

Agent for sale of Mines and Mineral Lands.

CORRESPONDENCE SOLICITED.

Agents in England and New York.

E. H. SARGENT & CO.,

IMPORTERS AND DEALERS IN

ASSAYER'S MATERIALS,

Chemicals and Laboratory Supplies.

125 State Street,

CHICAGO.

HARRIS & CAMPBELL

Latest Designs in Drawingroom, Diningroom and Bedroom

FURNITURE

With improved Steam Machinery our facilities for manufacturing Cabinet Goods are complete. Our upholstery Department is well stocked with latest imported patterns.

Corner QUEEN & O'CONNOR Sts.
OTTAWA.

THIS YEAR'S

MYRTLE

CUT AND PLUG

Smoking Tobacco

FINER THAN EVER.

SEE

T & B

In Bronze on Each Plug and Package.

THE DOMINION

SAFETY BOILER CO.

MANUFACTURERS OF

The "Field-Stirling" Patent High Pressure Boiler,

The Safest and Cheapest Steam-Generator now in Use.

This Boiler is unusually durable, being made of the best steel and wrought iron exclusively. No cast-iron is employed. It is simple in construction, has a rapid, well-defined circulation, and a large cool mud-drum, where all impurities are collected to be blown off. All parts of the Boiler are readily accessible for the closest inspection. It has great excess of strength and is not liable to be strained by unequal expansion. The water space is divided into sections so arranged that NO EXPLOSION IS POSSIBLE.

Some of Our Leading Customers:

The J. A. Converse Mfg. Co. (A. W. Morris & Bro.), Montreal; The Canada Sugar Refining Co., Montreal; The Pillow and Hersey Mfg., Montreal; The Berthier Beet Root Sugar Co., Berthier, Que.; The Imperial Insurance Co., Montreal; The Massey Manufacturing Co., Toronto; The Acadia Coal Co. (Lt'd.), Stellarton, N.S.; Canada Paper Co., Windsor Mills, Que.; Royal Electric Co. (Central Station), Montreal; Dodge Wood Split Pulley Co., Toronto, and a repeat order from A. W. Morris & Bro., after five months' experience; Ingersoll Rock Drill Co. of Canada.

We guarantee Dry Steam and Great Economy of Fuel. Correspondence Solicited.

J. FRASER TORRANCE, M.E.,
P.O. Box 1707, Montreal. Manager

If you want

BAGS

FOR PACKING

ASBESTOS, PHOSPHATES, ORES, &c.,

Send to us for Samples and Prices.

Every quality and size in stock.

Specially strong sewing for heavy materials.

Lowest prices compatible with good work.

We now supply most of the Mining Companies, and those who have not bought from us would find it to their advantage to do so.

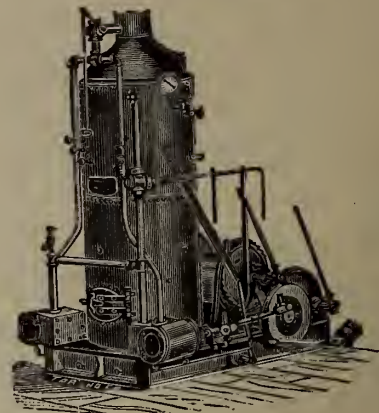
THE CANADA JUTE COMPANY (LTD.)

17, 19 & 21 ST. MARTIN STREET,

Established 1882.

MONTREAL.

M. BEATTY & SONS, WELLAND, ONT.



HOISTING
ENGINES
—
ENGINES
FOR
Mines
AND
Inclines

Horse-Power Hoisters,

Stone Derrick Irons,

Centrifugal Pumps



DREDGES,

DERRICKS,

STEAM SHOVELS,

And other Contractors' Plant.

AMALGAMATING MACHINERY.

Stamp Mills for Wet or Dry Crushing. Huntington Centrifugal Quartz Mill. Drying Cylinders. Amalgamating Pans, Settlers, Agitators and Concentrators. Retorts, Bullion and Ingot Moulds, Conveyors, Elevators, Bruckners and Howell's Improved White's Roasting Furnaces, Etc.

CONCENTRATING MACHINERY.

Blake, Dodge and Comet Crushers, Cornish Crushing and Finishing Rolls, Hartz Plunger and Collom Jigs. Frue Vanner & Embrey Concentrators, Evans', Calumet, Collom's and Rittenger's Slime Tables. Trommels, Wire Cloth and Punched Plates. Ore Sample Grinders and Heberle Mills.

FRASER & CHALMERS, MINING * MACHINERY.

Improved Corliss and Slide-Valve Steam Engines,
Boilers--Horizontal, Vertical and Sectional,
— IMPROVED STEAM STAMPS. —

Hoisting Engines, Safety Cages,
Safety Hooks,
Ore Cars, Water and Ore Buckets,
Air Compressors, Rock Drills, Etc.
General Mill and Mining
Supplies, Etc.



Pumping Engines and Cornish
Pumping Machinery,
Improved Water Jacket
Blast Furnaces for Calena and
Copper Ores.
Slag Cars and Pots,
Roots & Baker Pressure Blowers,
Suspended Tramways.

Sectional Machinery for Mule-Back Transportation.

General Offices and Works: FULTON & UNION STS., CHICAGO, ILL.

BRANCH OFFICES: NEW YORK, Room 43, No. 2 Wall St. DENVER, COLO., 1316 Eighteenth St. SALT LAKE CITY, UTAH, 7 West Second South St. LONDON ENGLAND, 23 Bucklersbury, E. C. CHIHUAHUA CITY, MEXICO, No. 11 Calle de Juarez. LIMA, PERU, South America. JOHANNESBURG, TRANSVAAL, South Africa.

Sole Western Agents for TYLER WIRE WORKS Double Crimped Mining Cloths.

The Canadian Mining Review

CONDUCTED BY

B. T. A. BELL

OFFICES:

UNION CHAMBERS, 14 Metcalfe St.

OTTAWA.

Vol. VIII. SEPTEMBER, 1889. No. 9.

Tenure of Nova Scotia Mineral Lands.

II.

Under the Mines and Minerals Act provision was made for the surrender of any lease at the option of the lessee. The practical working of the system of forfeiture adopted by the Government of the Province, coupled with the permission to surrender, became a curious mixture of good and evil. There were many properties which had been worked, and abandoned through a dullness of trade, litigation, etc., and many had been acquired for speculative purposes. When forfeiture proceedings were initiated the owner generally surrendered his lease and took it up again. The result was that those properties only became released to parties desirous of working them when the original owners believed them valueless or were not aware of the initiation of the forfeiture process. In the case of a lessee who kept a watch over his property the applicant for forfeiture soon became tired of enriching the Provincial Treasury without being able to get possession of the coveted ground. However in many cases where capital had been expended, work, etc., performed, on a lease, and unavoidable causes had led to a more or less temporary suspension of mining operations, this power of surrender prevented unfair appropriations of valuable franchises.

Still it became evident that the best interests of the mining public were not served by this state of affairs, for it meant practically that in many districts large blocks of ground were retained by parties who could not afford the expense of an occasional surrender and release, and held their titles in the hope of benefiting by the discoveries of their working neighbours. The Government however for a number of years considered that as large amounts of capital had been invested and bona fide work performed, that it would not be equitable, even at the risk of encouraging a system of tenure for purely speculative purposes, to permit properties whose owners had been bona fide miners to have no protection from outsiders who desired to acquire at nominal rates more or less developed properties.

Finally, at the last session of the Provincial Legislature it was enacted that all future leases of gold mining areas should pay an annual rental in advance of fifty cents for each area of 150 by 250 feet contained in them, to be refunded if the labor required by law on the areas was performed. It was also settled that all future leases of minerals other than of gold and silver should pay an annual rental of thirty dollars for each square mile or part of a square

mile contained in them, to be refunded if the total amount of royalty paid in any year exceeded the rental. It was also agreed that the holders of any outstanding leases could come in and avail themselves of the provisions of the Act as respected rentals and their refund.

It must be admitted that the amount of rental charged is low, lower in all probability than would be conceded by a private individual, especially in the case of minerals other than of gold and silver, where it is, roughly speaking, about one half that charged in the other class of leases. The law, however it may work in practice, has been well received by the mining public, the investor being willing to pay a moderate rental, while it is no burden on the lessee who is working and paying his royalty. Under the former statute it has frequently happened that proposing investors were deterred by the possibility of forfeiture proceedings, and the interruption to title incident upon the surrender of a lease, while now the title becomes practically held under the safest of all conditions, an annual acknowledgement thereof on the part of the Crown.

In the absence of any discretionary power it becomes evident that the treatment of defaulting lessees is governed by fixed laws which inflict upon the legitimate miner who had done his best, and had worked faithfully but with ill-success, greater trouble than on the speculator who had risked only the fees necessary for acquiring title. The idea of a rental compromise was a happy endeavor to unite flexibility and tenacity of title. Under the United States law the acquisition of the absolute title by a fixed expenditure, has locked up many mines, and has deprived the mining industry of opportunities of benefiting by legislation; but there is an attraction about absolute ownership that is valuable in any attempt to secure title to mineral lands.

Under the conditions governing the revenue of the Province of Nova Scotia the problem of the best method of handling its mineral resources so as to benefit the miner and maintain the royalty returns is a difficult one. Practically speaking the mines royalty is the only elastic source of revenue, as the Dominion grant is virtually a fixed one. It therefore became necessary to retain the system of leasing in order that the source of revenue should not pass out of the hands of the Government, and to impose a rental to prevent speculative monopoly. The value of the royalty account may be learned from the following figures giving the gross revenue from 1880 to 1888:—

Year 1880.....	\$ 70,440.52
1881.....	101,705.35
1882.....	108,809.51
1883.....	121,970.64
1884.....	100,678.36
1885.....	119,229.37
1886.....	126,856.91
1887.....	148,773.79
1888.....	153,818.30

The cost of running the Department has been raised from \$6,000.00 to \$14,000.00, and in this expenditure is included large payments for schools of instruction for miners, begun under the auspices of the present administration.

The Province deserves commendation inasmuch that a steadily maintained policy has preserved to it most valuable mineral franchises yielding an important and increasing revenue, while at the same time all proper legislative assistance, security of title, and an impartial miner's court are conferred upon the lessees, instead of having to deplore the granting at nominal rates of mineral rights liable to any monopoly, and to the inevitable diminution of value arising from change of boundaries, unchecked and reckless working, and the interminable toils of land title.

Raw Phosphates.

The evidence for the use of the crude Canadian Apatite, finely pulverized, is constantly accumulating. Many cases are reported where its application as a fertilizer has produced marked results.

Its effect upon flowers is clearly established. The enterprising foreman of the Emerald mine, Capt. Henwood, has been accustomed to take the fine dust obtained in drilling holes in the phosphate and apply it to his flower beds, and he vouches for its benefit. Capt. Adams, of Montreal, has taken a great interest in this question and has widely distributed samples for tests. He states that in four different cases where raw phosphates was applied to pansy seeds in competition with some in identical soil without phosphate, the plants and flowers of the former were double the size of the latter and survived a winter out of doors while all the other plants perished. A similar advantage as to growth was obtained with carrot seeds. In an interview with him this week he informs us that he has seen great results this summer upon a farm in Maine, and has eaten string beans raised by Canadian phosphate three weeks ahead of the season. He allows us to publish the following testimonial:—

Blue Hill, Maine, July 27, 1889.

Capt. Robt. C. Adams,
Managing Director,
Anglo-Canadian Phosphate Co., Ltd., Montreal.

Dear Sir,—I have used the crude ground phosphate from your Battle Lake Mines upon portions of various crops, and in every case the benefit is apparent. Two adjoining plots were planted with beans, one with stable manure and one with raw phosphate and manure. The latter came up a week earlier and is now a fortnight ahead of the other. The visible difference is very marked.

Oats were planted in three sections:—1, without manure; 2, with Bradley's superphosphate; 3, with raw phosphate. No. 3 has yielded the tallest crop and heaviest grain, and is more developed every way. No. 2 was better than No. 1, but the improvement was not so great as between No. 2 and No. 3.

Potatoes were tried with raw phosphate and without any manure. In one field there was not much difference to be seen, but in another the raw phosphate produced the largest potatoes.

With peas the results were decidedly good. The rows treated with raw phosphate are more forward than those that received no dressing.

Experiments have been made upon grass, but the effect of the raw phosphate cannot yet be determined.

The results obtained are such as to satisfy my mind as to the fact that crude mineral phosphate is an effective and quick acting fertilizer, and in these cases has proved superior to the other substances tried.

I am, yours very truly,

(Signed),

ERNEST R. DODGE.

We consider this topic of vast importance, as it means a reduction of from one-half to two-thirds in the cost of fertilizers to the farmer. It also permits the utilization of low grade phosphates heretofore valueless. The establishment of this theory, namely, that phosphate does not need to be treated with sulphuric acid in order to be made available for plant food, will be an inestimable boon to the agriculture of the world and will give a marvellous impulse to the phosphate industry of Canada. We shall welcome further evidence tending to the establishment of these ideas.

The Visit of the American Institute of Mining Engineers to Ottawa.

As already intimated in these columns, Canada is to be honored this year with the Autumn Meeting of the American Institute of Mining Engineers, which will be held at Ottawa during the week commencing Tuesday, 1st October, next. No better description of the growth and progress of this admirable institution can be given than that of Mr. Wm. B. Potter, E.M., St. Louis, who, in his Presidential address at the New York meeting, held in the beginning of the present year, said:—"The Institute is now fast approaching the year of its majority. More than eighteen years ago it came into existence in the town of Wilkesbarre Pa., and was welcomed as a long-desired heir, who should, in time, gather together and organize the scattered and neglected interests of the great estate of the profession, and be the means of adding new riches of knowledge to the store and new honor to the name, as well as benefitting mankind. The achievements of all these years have proved that the expectations were not in vain. The twenty-two who first assembled at Wilkesbarre to organize the Institute are, many of them, still with us; but their number has increased, until there are eighteen hundred and more. All parts of this continent are represented in the membership, as are the chief countries of Europe and South America and parts of Asia, Africa and Australia; and the list embraces the names of many who have been foremost in the achievements of all branches of the profession. The fifty-two meetings that have been held in the leading industrial and commercial centres of the land have been the means of extending the influence and reputation of our calling and promoting the influence of true science and sound practice. Not far from a thousand papers have been contributed upon subjects relating to the constitution and occurrence of nature's varied stores, as well as their exploitation, preparation and treatment to adapt them to the use and benefit of mankind. The sixteen volumes of published *Transactions* containing this lib-

eral contribution form a rich and useful store and furnish abundant proof of ability and zeal as well as faithfulness of members to the cause the Institute upholds."

A suggestion from the Canadian members to hold the Autumn meeting of the Institute at Ottawa having been very warmly received at the New York meeting, steps were at once taken to accomplish this end. A meeting was held in the office of the REVIEW early in March, which eventuated in a large and influential gathering of the citizens in the City Hall. Delegations to the Federal, Ontario and Quebec Governments were still further encouraged by grants of one thousand dollars from each to a fund for their reception. A formal invitation to the Council was sent and at once accepted. The following may briefly be stated to be the programme prepared by the committee for the occasion:—

Tuesday, (1st October)—Evening session.

Wednesday morning—Drive to the Chaudiere Lumber Mills and Factories, Experimental Farm, &c. Afternoon and evening sessions.

Thursday morning—Drive to Parliament and other public buildings, Geological Survey, Museum, &c. Afternoon and evening sessions.

Friday—Excursion by rail and river to the Lievres Phosphate mines.

Saturday—Excursion to the Canada Copper Co's mines and works, Sudbury, and on to the silver mines at Port Arthur.

Excursion to the Eastern Townships, visiting the Asbestos mines at Black Lake and Thetford, the Rockland Slate Quarries, the Dudswell Lime and Marble Works, &c.

The Buckingham excursion will leave Ottawa about 8.30 in the morning. At Buckingham village, steamers and scows sufficient to accommodate several hundred will be provided by the mine owners to convey the party up the Lievres. At the Little Rapids lunch will be served in a large marquee, and an opportunity given to visit the mines. As it will be impossible to see the larger mines, further up the river in time to return to the city on the same day, accommodation will be furnished at any of the mines to any of the engineers who may wish to remain over night.

At 1.50 Saturday afternoon a section of the Institute will leave for Sudbury and Port Arthur. Sunday and a part of Monday will be spent at Sudbury, where the mines and works of the Canadian Copper Co., the Dominion Mining Company etc., will be visited. At Port Arthur, the Mayor and Corporation will tender the distinguished visitors a public reception. Arrangements will also be made to allow them to visit and inspect the Beaver, Silver Mountain and other well known mines in the neighborhood. The whole trip will occupy a week or ten days, and will fully absorb the amount voted by the Ontario Government, *ie.*, one thousand dollars.

The excursion to the Eastern Townships will also leave Ottawa on Saturday, 5th October. The train is timed to reach Sherbrooke early on Monday where a Special will convey the party to the Asbestos mines at Black Lake and Thetford. At the latter point the mine owners and

managers will tender the visitors a lunch. At Sherbrooke, the Mayor and Corporation will give a reception in their honor on Tuesday. The new Rockland Slate Quarries, the Harvey Hill Copper Mines and other places of interest will in all likelihood be visited.

In all of these excursions transportation and Pullman facilities will be furnished without expense to the visitors.

The Sessions will be held in the large suite of rooms in the House of Commons, known as the Railway Committee Rooms. These all adjoin one another, and in one at least there is ample accommodation for two or three hundred at a sitting.

We are in a position to announce the following among other papers to be presented at the meeting:—

"The Geological Relations of the Nova Scotia Minerals"
E. Gilpin jr., Deputy Comr. of Mines, Halifax.

"Notes on the Gold Mining Interests of Nova Scotia."
John E. Hardman, M.E., Oldman, N.S.

"The Canadian Phosphate Deposits."
Dr. Robert Bell, Asst. Director, Geo. Survey.

"The Silver Veins of the Port Arthur District."
E. D. Ingall, M.E., A.R. S.M.

"The Mining Interests of Eastern Quebec."
Dr. R. W. Ellis, Geological Survey of Canada.

"A Reminiscence of Fierberg."
Thos. Macfarlane, F.R.S.C., Ottawa.

"The Possibilities of the Iron Manufacture at Ottawa."
John Birkinbine, Editor *Iron Age*, Philadelphia.

"The Sudbury Copper Mines and Works."
Dr. E. D. Peters, Jr., Sudbury.

"Notes on Some Coals in Western Canada."
W. Hamilton Merritt, M.E., Toronto.

"Gold Quartz."
W. M. Courtis, Detroit, Mich.

"Remarks on the Metallurgy of Tellurides."
Frank C. Smith, Ann Harbor, Mich.

"Ventilation, Progress and Cost of the New Croton Aqueduct."
J. P. Carson, Dobb's Ferry, N.Y.

"Stamp Mills."
John Hays Hammond, San Francisco, Cal.

"The Wear of Rails as Related to Their Sections."
P. H. Dudley, New York.

"The Columbia Iron and Steel Works, Pittsburg, Pa."
G. W. Maynard, New York.

"The Huantla Mining District, State of Morelos, Mexico."
G. W. Maynard, New York.

"The Physical Properties of Aluminum, and a Comparison of it with Other Metals."
W. J. Keep, Detroit, Mich.

"Phosphorus in Cast Iron."
W. J. Keep, Detroit, Mich.

"The Davis-Colby Roasting-Kiln."
S. G. Valentine, Lebanon, Pa.

"Commercial Economy."
Dr. R. W. Raymond, New York City.

"Biographical Notice of William W. Scranton."
Dr. R. W. Raymond, New York.

"Canada's Great Geologist, Sir William Logan."
Dr. Robert Bell, Ottawa.

"Biographical Notice of George H. Cook."
J. C. Smock, Albany, N. Y.

The date of the Meeting will, unfortunately, preclude the attendance of many of the professors of the American Mining Schools, since the opening of the school term requires them to be at their posts. A large number of members have just returned from a European trip of several months; some are still abroad; another considerable number attended the Colorado meeting in July, and these, with those who have just returned from the Toronto meeting of the American Association for the Advancement of

Science cannot get away again this year; and finally, Dr. Raymond informs us, there is a decided revival in business, blast furnaces are being blown in, contracts are under negotiation, and engagements are more important and imperative than usual. In spite of all these drawbacks it is gratifying to know that the attendance at the Ottawa meeting will still be large. Their coming to the Capital of the Dominion will increase the importance of Canada and Ottawa, not only to our neighbours but to the world generally. The reading and discussion of papers of practical interest to the profession cannot fail to be interesting and profitable to our mining men; the excursions will bring our mines and immense areas of undeveloped wealth into the prominent notice of those likely to invest or to influence the investment of money in them; to say nothing of the direct and immediate advantage to our city and the Country generally to be gained from the visit of such a large number of strangers with money to spend.

We join with the Canadian members—and we are sure with all in any way connected with our mining interests, in bidding a cordial welcome to Ottawa to the members of the Institute.

Practical Economy in Gold Mining.*

B. C. Wilson, President Gold Miners' Ass'n. of Nova Scotia

In working for coal, iron, or any of the baser metals it is understood that the operations must be carried on with system and economy, because they are subject to so much competition; but gold has no competitor in the market, does not vary in price, and being the monarch among metals "Feels not the wants that pinch the poor," and yet, perhaps, there is no branch of the mining industry where economy is so essential to success, and yet so neglected in practice as in gold mining, and this is applicable the world over, though here in Nova Scotia, where we are pronounced behind the age in so many things, I think in this particular of neglected economy we are quite to the fore. Not that I insinuate by any means that as a community we are exceptionally extravagant or wasteful, but it is the remark of visiting mining engineers that there has been work enough done on the mines in Nova Scotia, if properly and carefully applied, to have efficiently and profitably developed every mine in it, while in effect but little more has been done than merely prospect them, and demonstrate their remunerative character under the most expensive and unsystematic methods. But ages ago the Jewish sage placed it on record that "the destruction of the poor was his poverty," and to this cause the poverty of the early investors, and the apathy of the local capitalists, is to be attributed the very expensive yet inefficient working of our mines in the past; and yet it is also the strongest evidence which can be adduced of the remunerative character of the Nova Scotia gold mines, that in spite of the lack of means among the pioneers in the business, and the consequently enhanced expense of "the hand to mouth" operations where hand labor had to do what steam and mechanism should have been harnessed to, that yet the Government records from 1864 to 1884 show an average yearly return of \$660 to each man employed.

Of course they worked near the surface and creamed it, or more properly skimmed it, but

when seventy men at a cost of \$100 a day were employed to do the work of a ten horse power engine, as I have seen in actual practice for months, aye for years, at a time, I think the value of the mine and absence of economy are fully demonstrated.

Of course the day of such exceptional extravagance has passed, but there is much room for improvement the province over in the methods of working, in the concentration of interests, in the systemizing and division of labor, and in the introduction of improved labor-saving machinery all supplemented by experienced, intelligent management.

As capitalists and combinations of owners absorb the small holdings of the original owners, and works of greater magnitude are inaugurated, it follows that the field for economy or extravagance is proportionally enlarged. And foremost among the difficulties, the competent and progressive manager will be confronted with, will be the prejudices of the operative miner to any innovation in the method of working the mine or reducing the ores as compared with what they have been accustomed to, for though our Nova Scotia miners compare very favorably in intelligence and ability with any in the world, yet they do not take kindly to what departs from their heretofore practice, or to any system which reduces the number of workmen, or increases the results of their labor, considering it inimical to their interests, forgetting that reduced cost of production or increased results from the ore, proportionally enlarges the field and demand for labor. But to their credit, I must testify they are open to conviction and accept the situation if it is fully demonstrated and illustrated, but the manager has got to take the initiative and do this. The men will never do it.

The concentration of machinery and power about a central shaft, or distributing point, instead of independent powers at a number of shafts on one lode or to a series of lodes, as compared with the early practice of separate hoisting and pumping from a number of shafts on one lode, or from an adjoining, perhaps not twenty feet away is a long step towards economy, and once established, there is no danger of retrogression.

OVERHAND STOPPING.

This system also tends to inaugurate a different method of working: notably from underhand to overhand stopping. I am far from advocating overhand work in every instance, but unquestionably it is the proper and by far the most economical in a great many cases. Of course it involves the original outlay for shafts and levels in advance of any return, and this is why it has never been popular with our miners; they had to get returns every month and so the underhand system became established.

Under the tribute system which prevailed in our mines for so many years, (and a most pernicious system it was) the larger lodes of low grade ore were avoided owing to the fact that the crusher in taking toll of three to four dollars per ton left but little for the miner. He preferred a narrower lode of richer ore and did not mind working a month for a ton of ore if it gave a return of two ounces. It is only within the last year or two that the larger veins have attracted attention or been considered valuable. These larger veins offer facilities for economy in mining by the introduction of power drills actuated by steam, compressed air, or electricity. There has been some prejudice against those drills, but once introduced I have every confidence they will retain their foothold. An important drawback at the present time is the limited number of men in the country who are

familiar with their use, but time and demand will remedy this. The schoolmaster is abroad in mining and we need not fear for the results.

Many of our lodes can be worked to advantage with power drills, but there are many others where the local conditions are not favorable, particularly where the vein is very thin or the lines of cleavage admit but very narrow working space, or a soft gouge admits removal with very little explosive. In such places there are chances for a revelation in economy in the one man process, that is, each man to hold and strike his own drill. I know there is a decided prejudice among our miners to this method. They are not educated to it and have an idea that it imposes more labor, which however is a fallacy.

In the early days of mining here, when the only experienced miners were from Cornwall, they all preferred to work that way, and when under contract always would do so, but "cousin John" when hired by the day was not slow to adapt himself to "the Yankee ways," and a "soft thing" as he termed it. I have in mind several lodes, now idle, some of which have been profitably worked in this way in the old powder days, and could be made more remunerative by the same method now with dynamite, and I confidently look to a revival of this process with satisfactory results. Given a vein when the conditions apply, and an importation of half a dozen Cornish miners accustomed to this mode of working and the whole lump will soon be leavened. It only requires some one to take the initiative.

BLASTING.

Associated with drilling comes blasting. It has always been the custom, is largely so yet, for each man or set of men to drill and blast their own holes; the latter at such time as suited their own convenience regardless of how many men were driven from their work, nor did the men care either, the mine paid for it all. That such a system is a relic of the past, is expensive, unsystematic, and should become obsolete goes without argument.

If as some argue the operations are so limited that this is the best way of doing, I can only say in reply, "Sell out to some one who can work it on broader principles." That many cases will occur, notably in the preliminary work incident to properly fitting up a mine, where it will be necessary to blast at unreasonable hours, I admit, but it does not follow that nearly all the blasting may not be done at times when the men are out of the mine as at change of shifts and meal hours, and that all the holes be loaded and fired by one man specially detailed for that purpose, and where practicable that simultaneous firing by battery be adopted. I have paid for knowing that there is a grand chance for economy in this operation of blasting. And just here I have been met with the assertion that men under contract cannot afford to be placed under such restrictions, and also if the contractor sees fit to use more explosive than necessary or to hustle his men out as he pleases whose business is it? he pays for it. Just so, but the mine has to pay it all in the end. And this brings up the contract question, whether it is the proper method at all or not. That depends.

In many cases contracts can be given with advantage to both mine and men, but I believe not generally so. To come to the pith of the question: Is it not a fact patent to all that a man or a number of men will not take a contract, at least not continue it, unless they can make more than day's pay, and is it not equally patent that they do not work harder under contract than by days' work, and does not every experienced manager know of the trimming and

*Read at the September meeting of the Gold Miners' Association of Nova Scotia.

combining, and nursing of a good contract so as not to make it pay *too well*? And the mine pays for it all.

And again brain is an important element to successful mining as well as brawn. It is fully conceded that many contractors bring more brain to the work than their employers,—sometimes. But contracts are given out indiscriminately, and likely as not to a man who has not sufficient executive ability to run a wheelbarrow. Their short-comings have to be paid for, and paid at both ends too. First to make good their discrepancies, and next, in the enhanced prices which it is necessary to pay their shrewder competitors, who are not slow to take advantage of these opportunities thrown in their way. And the mine pays for it all! I believe on general principles there is no better system than efficient working managers over men, and operatives hired by the day, and paid in cash every month, or, better still, every week.

I know that the contract system has the *prestige* of government precedent, and the glamour of competition to soothe the owner and satisfy criticism, and also affords opportunity for much more elegant leisure on the part of the manager, foreman, and other non-combatants, to use a military term.

CRUSHING.

That there is ample room for economy in crushing the ore I think no one will dispute. During the "tribute" days the price charged for crushing, three to five dollars per ton, acted as an incubus upon mining interests and development. And yet I have known mills charging \$2.75 per ton which did not make enough at that price to meet their bills. And it was considered a marvel of success when another mill made an average of \$1.08 on six months' running, but this made no provision for cost or depreciation. But in the light of the fact that there are mills running in America to day on ore which yields less than \$1.00 per ton, the cost for crushing alone in Nova Scotia does not look encouraging.

The ore-breaker is beginning to supplant the process of hand breaking with hammers, and the automatic feeder is also coming to the front. But if every mill owner in the Province who has these improvements would hold up his hand, would there be a show of half a score?

Of course the cost of crushing is materially enhanced by the limited capacity of the mills, and the further fact that the small lots crushed necessitates cleaning up very frequently. And an initiatory step towards reducing the cost, be the mill large or small, is to keep the mill continuously supplied with ore. Taking things as we now find them. For instance with steam power it usually takes three men to run a ten stamp mill. Now if fifty stamps were used the three men could run it still; while the concentration of power and fuel would be quite a saving. And I have no doubt that a properly equipped and operated mill could crush quartz for 50 cents a ton, presuming, of course, that fifty to one hundred tons a day are treated. And there are plenty of properties here capable of furnishing that amount and keeping it up for years; but I have yet to learn of one mine producing fifty tons per day. However I have confidence that in the very near future we shall have mines producing that, or double it.

Artificial light has to be used in a mine. What electricity will do for us is a problem the future will solve for us. It is being introduced and may become the light of the future; in the meantime candles and oil have to fill the demand. Which of these is the best is a matter of opinion among the respective advocates.

Lighting is one of the little expenses which combine to swell the bills, and sometimes very considerably. I can call to mind an instance where a miner with an eye to economy fattened two fine porkers from the ends and broken candles bailed up with the water, and picked out of the quartz! Neglect on the part of the overseers, you will say, and very truly; but the mine paid for it all. It only goes to prove what an omnipresent individual the manager of a mine needs to be to stop those thousand and one leaks.

The economizing of fuel in mines worked by steam is a matter generally receiving special attention and affords the best guarantee of improvement in the future.

In short, while it is not advisable to economize a dollar at the expense of two to save it, it certainly is consistent to make economy an important element of the management, and to bear in mind that the matter is one over which the mine manager holds sovereign control. On him devolves the duty and authority of so systemizing the work that the greatest remunerative results are obtainable; to see that the mechanical appliances are efficient; that the workmen are prompt to duty; that the drilling, blasting, and in fact all work is managed by the department, and not by the men; that shifting of rock and other unskilled labor is apportioned to the rank and file of the pay roll and not to the skilled operative, whose duties are of a higher order, and consequently involve higher wages; that there is no intentional or unintentional neglect or carelessness of the men as regards care of tools, lighting, fuel or any property of the mine; to see that there is no piling back on scaffolds, or dumping ore under foot because it is easier to do so than pass it to the surface (an outcome of the contract system); that the transport of ore from mine to mill is done with due regard to expense as well as security against pilfering or even unintentional loss; that the ore-breaker and automatic feeder are substituted for the pernicious and expensive hand process.

To keep a sharp eye upon the use of cyanide or acids either in the mortars, upon the plates, or in cleaning the gold, and prohibit the throwing away of any resultant liquors, and to restrict, or better still, abolish the use of the magnet in cleaning up or panning out, and see that no accumulations of iron from the stamps, heavy pyrites, old crucibles, slags, etc., are allowed to be thrown away or carried away; and particularly that the floor of the mill is either perfectly water tight or of sand which can be taken up occasionally and passed through the mill. For gold and quicksilver will elude the most careful manipulator. And need I mention it? To see that his men are paid promptly *whether the mill is cleaned up or not*, for the moment men find their pay is behind the specified time they take alarm and set back in harness, work with a half-hearted energy which the foreman is powerless to overcome. It is an important economy to keep your men paid promptly.

The purloining of gold by persons around the mine hardly comes under the head of economies but is none the less important to success, and one which the manager will find it necessary in practice, if he doesn't consider it judicious to establish, in principle. To reverse the time-honored English precedent and in a measure, at least, believe every man guilty until he has proved innocent. If this expression may seem to reflect too severely on the moral standard of mining humanity I have only to remark that it is not every mine which can afford to lose \$25,000 to \$50,000 a year in this way, and I can name more than one in the Province which has suffered to that extent.

PHOSPHATE.

In General.

Mr. Hutcheson, of the Anglo-Continental Guano Company (late Ohlendorffs) accompanied by Mr. P. Würzemburger, M.E., Antwerp, are now visiting the mines, and making a full investigation into our phosphates with a view to securing supplies for the immense requirements of their large fertilizing business. The visit of capitalists of such high status is a very hopeful sign of the commercial future for our Canadian phosphate trade.

Ocean Shipments.

The following is a statement of the phosphate shipments from the Port of Montreal to date, unreported since our last issue.

Date.	Vessel.	Destination.	Shipper.	Tons.
Aug. 17	S.S. Gleniffer	Liverpool	Millar & Co.	250
" 17	" Ocean King	London	Lomer, Rohr & Co.	50
" 28	" Toronto	Liverpool	Millar & Co.	425
" 30	" Gerona	London	Lomer, Rohr & Co.	392
" 30	" Osiris	Grimsby	"	200
" 31	Bk. Eidsiva	Cardiff	"	100
" 31	S.S. Concordia	Glasgow	Wilson & Green.	407
Sept. 7	" Angers	London	Lomer, Rohr & Co.	150
" 7	" Harbinger	Glasgow	"	200
" 12	" Haverton	London	"	168
" 14	" Canopus	Liverpool	Wilson & Green.	384
" 15	" Erl King	London	Lomer, Rohr & Co.	150
" 17	" Smeaton Tower	"	Wilson & Green.	200
" 20	" Alcides	Glasgow	Lomer, Rohr & Co.	250
Total				3326

Lomer, Rohr & Co.	1660 Tons.
Wilson & Green.	991 "
Millar & Co.	675 "

Total..... 3326

RECAPITULATION.

London	1110 Tons.
Liverpool	1059 "
Glasgow	857 "
Grimsby	200 "
Cardiff	100 "

Total..... 3326

Shipments.

Notwithstanding the scarcity of ocean freights and the difficulties of transportation on the Lievres, it is confidently expected that the shipments for the present year will be fully up to 25,000 tons.

Through the courtesy of Col. Lay, the new U. S. Consul-General at Ottawa, we are in a position to state that the shipments of ground phosphate from the Ottawa Valley to points in the United States, for the fiscal year ended 31st June last, were of a value of \$24,584.62—or 2,458½ tons at \$10 per ton.

The value of ground phosphate exported from Ottawa County mines to the United States for quarter ended this month is \$7,760, or 776 tons at \$10 per ton. These are the largest shipments from Ottawa County reported for any quarter during recent years.

Markets.

Markets are firm with an upward tendency. Sales have been made lately at the following quotations: 500 tons 75 to 80% at 1/ per unit, rising; and 10½d for 70% rising. The outlook for Canadian phosphate is certainly encouraging.

Ocean Freights.

Freights continue to be scarce. The following may be quoted: Liverpool, scarce @ 7/6, London from 9 to 10/, Hamburg about 14/ to 15/, Glasgow 6/6.

Kingston District.

The output from the Foxton mine from 1st May to 1st September figures 900 tons, averaging 82 per cent., together with a considerable quantity of uncobbed phosphates. The vein is now reported to be 64 feet in length by 8 feet in width, consisting of pure phosphate unmixed with rock. The above mentioned 900 tons were mined and cobbled by about 18 men. The mine is improving as the work progresses. Five hundred tons have already been shipped from Kingston.

Perth District.

Very cheering reports continue to be received from the pits of the Anglo Canadian Phosphate Company at Bobbs Lake. Particular mention is made of one of the pits which shows a vein 50 feet long, and from 3 to 4 feet wide, of solid phosphate. From this pit, four men have taken out 73 tons in four weeks. The company were unlucky enough to have 325 tons on the unfortunate s.s. Montreal which stranded lately off Belle Isle.

Templeton District.

Dr. Robert Bell, Assistant Director of the Geological Survey, paid a visit this month at the Blackburn mines. He reports that a great deal of prospecting has lately been done on the virgin lots adjoining the main workings, and that all the openings show large bodies of rich ore that will amply repay further development. More powerful machinery has been put in at the old pits and many improvements all round are being carried out. These operations have naturally interfered with the output, but hauling has lately been resumed.

Du Lievre District.

At the North Star mines new machinery is being put in place and a large output continues to be maintained. It is thought that the total product for the year will be close upon 8,000 tons.

Operations at High Rock go on much as usual. All the pits are now looking exceedingly well. 384 tons from this mine were on the S.S. Canopus which took fire on her outward voyage on 22nd inst. At time of writing it is not known how much, if any, of the cargo is damaged.

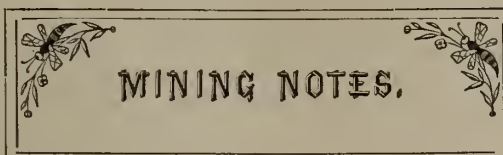
Mr. C. C. Hoyer Millar, of Messrs. Couper, Millar & Co., London, is at present on a visit to the mines of the Canadian Phosphate Company in which he is very largely interested. Mr. Millar states that all the pits look exceedingly well, and that a large quantity of phosphate is being mined and shipped.

The Squaw Hill property adjoining the Emerald, and owned by Mr. A. F. McIntyre, is reported to be looking better than ever. All the shows give abundant evidence of pay ore.

The crushing plant at Lomer's Mill is running full time. The management have in hand permanent orders for the whole production right through the winter. To date about 800 tons of ground phosphate from the mill have been exported this season to United States.

Measurement of Earth-Pressure in Mines.—In the mine at Stassfurt, belonging to the Prussian Government, the following contrivance has been adopted to measure the vertical change caused by the thrust of the strata. Wooden plugs, each a yard in length, are driven into the floor and roof. On to these plugs two

iron tubes are screwed. The tubes do not meet, but a guide-pin attached to the lower one slides up and down within the upper one. At the side of the tubes a vertical board is fixed in such a way as not to touch the roof or floor. Two metal frames are fixed to the board, so that their ends are in close proximity to the tubes. At the back of these frames is the centre of a lever, the shorter arm of which is connected with one of the tubes, whilst the longer arm serves as a pointer that is free to move over a scale divided into centimetres on the board. The pointer is adjusted to zero, and the depression of the roof and the rise in the floor are indicated by the movements of the pointer.



We shall be greatly obliged to mine owners and superintendents for such authentic reports of their operations as may concern shareholders and the public.

Nova Scotia.

The Londonderry Iron Company, whose works are near Londonderry, N. S., will pay out in wages to their workmen this season \$252,000. They will also pay the Intercolonial railway \$100,000 for freight charges.

The Steel Works, New Glasgow, are credited with making one of the largest castings ever made in Canada. It weighs 35 tons.

Killag.

Work in this district has been steadily pushed this summer by Mr. Geo. W. Stuart. The difficulties of prospecting here, owing to the swampy character of the surface, are unusually great. The surface is 31 feet deep, the first six feet consisting of black turf and mud, and the remaining twenty five of large boulders and quicksand. Early in the summer a pumping and hoisting gear was set up near the centre of the swamp, and a shaft has been pushed down fifteen feet into solid rock. From the bottom of this shaft a cross-cut to the north is driving. The tunnel is now in over forty feet, and the management expect to cut the rich lode, so long looked for, in about sixty feet more. It is interesting to note that the black turf cut through in the surface, when piled up and dried, proved to be a peat of excellent quality. Mr. Stuart has tried some of it under the boiler and reports that one fire, with closed doors, sufficed to keep up the steam whilst pumping and hoisting for two hours. Killag is blessed with plenty of good fuel in the shape of big hardwood, but this experience of Mr. Stuart's may prove of far more value than appears at first sight.

Gold Mining Supplies.

The principal depot in Nova Scotia, carrying the most complete assortment of first class goods, is

H. H. FULLER & CO'S,

41 to 45 Upper Water St., Halifax, N.S.

Our line comprises Explosives, Fuse, American and English Mill and Hammer Steel, Bar and Bolt Iron, Steel Wire Hoisting Rope, Hemp and Manila Rope, Rubber and Leather Belting, Miners' Candles, Oils and Lamps, Miners' Tools, Machinists' Tools, Blacksmiths' Tools, and every requisite for the gold miner.

H. H. FULLER & CO.,
Halifax, N.S.

Rawdon District.

Mr. Eugene Conrady has been appointed to the management of the Rawdon United Mines, and the British and Colonial Land Association Limited, of Mt. Uniacke, taking the place of Mr. John Nicholls.

Westfield.

The big swell of quartz, locally known as the "Jumbo" lode is not being worked now. Several reasons therefor are mentioned, but the principal one seems to be a lack of free gold.

Chezzetcook.

The drainage of Lake Catcha by the Oxford Gold Mining Co. has opened to prospecting a large territory hitherto inaccessible. The management has already cut thirty different lodes, and are now working on two lodes, each said to be about twelve inches thick. One lode shows gold freely, and is estimated good for thirty dollars per ton.

Beaver Dam.

The new owners of this property are working quietly, but steadily. The shaft is now down fifty six feet and is to be sunk to a depth of 120 feet. The belt is said to be forty feet in width, of which thirty feet, at least, is crushing material.

The ore obtained from the shaft in sinking, averaged nine dollars per ton. It is the intention of the management to have ten stamps running before Christmas, and to add more stamps as fast as the development warrants.

Malaga.

The Parker Douglas Co. is working steadily and keeping five stamps running. The Malaga Co. keep an average of about eight stamps running. But little information is accessible regarding this district, the returns to the Mines Office for the first six months of the year show an average yield of sixteen dwts. to the ton.

Cochrane Hill.

Mr. Ferd. Dietzsch, representative of the English syndicate, working at this mine for a year past, left on the 30th August. The mine is idle and has reverted to the hands of its former owners. The history of this property for the past twelve months has been illustrative of the folly of sending out English experts to manage small gold mining enterprises in this country. Unfamiliarity with the metallurgy of gold and extravagant business habits would ruin many richer mines than this.

Montague.

Quite a force of men are at work in this district. During the past six months of the year the average yield was \$33 per ton. Many very handsome and rich pockets have been found during the summer.

Central Rawdon.

The sale of the Gould-Northup mine at this place to a Pennsylvania syndicate has been announced. The property embraces nearly 45 acres. Mr. Chas. E. Willis, Manager of the Neptune Gold Mining Co., has also assumed the management of this company.

Sherbrooke.

This district reports a rich find on property lately owned by Mr. Hattie, now owned by Robt. McNaughton. The rumour is not denied by Mr. McNaughton. In other respects the district is very quiet, not more than half a dozen men being at work.

Caribou.

The Heatherington property in this district has recently been purchased by a new corporation known as the Truro Gold Mining Co. Amongst the names of the syndicate are those of some of the solid men of Truro. Work has already been started and will be vigorously pushed.

Wine Harbour.

The property here, under management of Mr. H. T. Harding, is doing well. 160 ozs. of gold were obtained last month. Some changes are to be made in the machinery plant which will increase the hoisting capacity.

Isaacs Harbour.

The output of the Palgrave Co. was considerably reduced last month owing to a breakage in the pumping gear, which occasioned a loss of eight days in the pit.

A valuable discovery of anthracite coal has been made at Cheticamp, Cape Breton, and on trial is said to have proved of excellent quality. One hundred barrels have been sent to England for analysis, and if it turns out as expected the mine will be at once developed to its fullest extent.

Quebec.

Very encouraging reports come from the New Rockland Slate Quarries. A very good quality of slate is being quarried from a productive bench at a depth of some 200 feet. A little over 16,000 squares have been taken out and made marketable since the beginning of the present year. About 200 men are now employed under Superintendent Williams. A heavy cave-in occurred recently which will delay operations for a few weeks.

The Anglo-Canadian Asbestos Company at Black Lake are quarrying an excellent quality of asbestos. During August, 103 tons were taken out, with an average of 40 men and boys. Mr. R. T. Hopper contemplates putting in an improved plant at an early date.

At the property of the American Asbestos Company, in the same district, work is going ahead very satisfactorily. There are between 100 and 120 men at work. Mr. Ed. Wertheim is working very systematically, and all openings look well.

Appropos of the scarcity of labor in the asbestos districts, a prominent mine owner writes: "Help has been very scarce in this district lately, many of the men having left the quarries for the farming districts, where, for the time being, they can earn a little more money. This is a common complaint at all the mines, and the output of asbestos is being very much hindered thereby. 150 to 200 men at least would find ready employment at the mines in this district alone. Perhaps you can do something to induce good strong men and boys to move to Megantic county. Living is cheap; comfortable houses are provided by the various companies at very reasonable terms; work is continuous summer and winter; and the place is contiguous to railway and post office. We should all prefer to have men who would stick to their places, and not wish to do farming and mining at the same time. This moving about does not pay them, for they lose time and money travelling, and very often their work at the mine, when otherwise they would have constant work at advancing wages. No skilled miners are required, as with us, nearly all drilling and hoisting is done with machinery, and the work consists in simply picking up the asbestos after the blasts, and in shifting the refuse rock on the derrick, boxes and lorries, while the boys do cobbing and cleaning." We gladly give space to the above in the hope that any of our miners who may suffer from irregular employment may be induced to make a change for the better.

The demand for Canadian asbestos continues to be strong. We are informed that sales have lately been made at the following advance on former quotations: 1st quality, \$125 to \$130; 2nd quality, \$75 to \$80; 3rd quality, \$35 to \$40; waste at \$15 per ton, 2,000 lbs, at mines.

The Thetford mines were lately visited by Mr. John Bell, his son Mr. Herbert Bell, and others very heavily interested in the Bell's Asbestos Co. (Ltd.) The party were greatly pleased with the appearance, output, and systematic management of the properties. A strong endeavor this year is being made to produce 2,000 tons. With a view to doubling the capacity of the pits, and in order to meet the enormous requirements of their business, it is understood that additional machinery will shortly be added to the extensive plant now in operation. The Bell's Company have, we hear, been awarded a large contract for asbestos supplies to the British navy.

A rather bad land-slide occurred, a few days ago, at the King property, which will seriously interfere with their operations for some time at least. Fortunately the cave-in occurred during the night, when no one was at work, otherwise a deplorable calamity, involving the loss of many valuable lives, must surely have taken place. Vigorous measures were at once taken to clear away the debris, and it is hoped that the output from the big pit will be resumed at an early date. The very nature of the ground in these Serpentine areas renders it liable to these accidents, particularly during the rainy season, and great care should be taken in the workings to avoid the possibility of their occurrence. Eagerness to produce large outputs should on no account be permitted to involve any possible risk to the safety of the men.

Mr. Wm. King continues to meet with encouraging results in the prospecting of his areas in the S. E. corner of the Township of Ireland. A number of very promising veins have been uncovered.

Work continues as usual at the Ross-Ward pits.

About 300 tons, of good quality, have been taken from the Frechette mine, to 31st August.

During the month a vein of unusually good length of fibre was uncovered at the Johnstone pit.

Complaints continue to be received regarding the non-appearance of the new government map recently prepared by Dr. R. W. Ells. It seems a great pity that a work of so much value and importance to the mining interests of the Eastern townships, should be so dilatory in publication and distribution. Much of the usefulness of the work of the Survey is often marred by the inexplicable delays which occur in the production of its Reports and Maps. Mining men are greatly disappointed that this map has not been placed in their hands before now.

We have noticed in one or two of the local papers a statement to the effect that the Harvey Hill mines had been closed down; this is not so. It is true that after the collapse in the copper market the mines were closed down until a decision was arrived at in England with regard to the treatment of the ore which had previously

been shipped in its crude state. Owing to the drop in the price of copper it was not deemed advisable to ship the ore in that condition until the smelting works had been put up, and work was consequently suspended. The mines are now working with a complement of from 50 to 60 hands, and the smelter is expected to be turning out matte in a few days. We are pleased to learn that recent openings have brought to light some new veins which promise to yield good returns. A visitor, who has just returned from the mines, informs us that there are very good prospects of this old and somewhat unfortunate property turning out a paying concern after all.

The owner of the South Ham antimony mine has commenced development work. The openings made are reported to look well.

The Graphite City Plumbago Mill, near Buckingham is now working. The new machinery and substantial buildings recently erected are very highly spoken of.

Through the courtesy of Mr. S. P. Franchot we have been favored with some beautiful samples of pottery ware, manufactured from the Villeneuve felspar, by Messrs. Oliphant & Co., Delaware Pottery Works, Trenton, N.J. About 52 per cent. of the Villeneuve spar is utilised in these manufactures. Mr. Franchot contradicts the rumour that the Villeneuve mine has changed hands.

Notice of application for incorporation is given by the Coleraine Mining Company. The capital stock of the concern will be \$600,000 in 6000 shares of one hundred dollars. The names in full and address and calling of each of the applicants are, the Hon. J. Chapleau, Ottawa, A. DeJardins, banker, L. DeMartigny, banker, Hon. A. Lacoste, advocate and Queen's Counsel, Dame Delphire Justine Dansereau, widow of the late the Honourable Louis Adélard Senecal, in his lifetime one of Her Majesty's Senators for Canada, all of the City of Montreal; the first four of whom are to be the provisional directors.

Ontario.

Sudbury District.

Our special correspondent, writing from Sudbury under date of 20th Sept., says:—

A traveller passing our quiet town by the C.P.R. would have no idea of the extent of the mining and smelting operations going on in various directions within a few miles of Sudbury. Notwithstanding this want of bustle at the town itself, the fact is that there is great activity in bona fide mining, and a large amount of money is being spent in the vicinity. The Canadian Copper Company is employing more men than ever on the three mines it is working at present, namely, the Stobie, the Copper Cliff and the Evans. It has other rich mines ready to work as soon as the demands of its furnaces require the ore. The new smelter went into operation on the 4th inst., and, like the first, it gives the utmost satisfaction. The two furnaces smelt about 300 tons of roasted ore daily. At the beginning of the month some ten train loads or about 750 tons of rich matte awaited shipment, and about 300 tons have been added since. The matte now averages 50 per cent. of metal—30 per cent. copper and 20 per cent. silver. The earlier shipments averaged only about 25 and 15 per cent. respectively.

One of the most promising features in connection with mining in this part of the country is the interest which is being taken in it by the Vivians, the great copper and nickel men of Swansea, Wales. They have had a large force of men under Mr. Merry of their own establishment at work all summer on the Murray mine, $3\frac{1}{2}$ miles north-west of this place on the main line of the C.P.R. The developments so far made appear to be satisfactory, and there is every probability that this extensive and influential firm, who were the first to prove the commercial value of the metal nickel many years ago, will establish a branch near Sudbury.

Work has been renewed on the rich copper deposit in Denison, about twenty miles from here, belonging to the Vermilion Mining Company, and it is said the Harwood mine will be reopened also. The C. P. R. Co. is extending the Stobie branch to the Dominion Mineral Company's mine and employing over 300 men on the work.

All these operations, in spite of the very low price of copper, speak volumes for the richness and other advantages of our mines, and furnish the best answer to the scientific croakers in your city who encouraged (!) us with predictions of failure at every step from the beginning.

We were lately honored by a visit from the Geological Section of the American Association for the Advancement of Science, who came here at the close of the Toronto meeting. The party included Professors Hitchcock, Hovey, Wright, Broadhead, Alexander Winchell, Claypole, Morley, Drs. Lawson and Green, Messrs. H. Winchell, State Geologist of Minnesota, and other eminent geologists. A correspondent of the New York *Tribune* accompanied the excursionists. On arriving at Sudbury they were met and welcomed by Dr. E. D. Peters, the celebrated metallurgist, who is at present general manager for the C. C. Co., and taken by rail to the various mines, the roast yards and smelters. While at the Stobie mine, a blast consisting of eight 10-foot holes charged with dynamite was fired by electricity and threw down a splendid mass of pure ore which was variously estimated to contain the enormous amount of from 300 to 500 tons. Some of your Ottawa men, who might at one time have acquired this mine for a song, would have been ready to "kick themselves" at the sight. One of the objects of the party was to visit our Huronian rocks, and the following day they were conducted to the most interesting exposures along the main line of the C.P.R. under the guidance of Dr. Bell, Assistant Director of the Geological Survey, who has been working in this district for the last two years.

Besides the C. C. Co., other companies are operating extensively. The Dominion Mineral Company, largely composed of Canadian Pacific Railway men, is developing one of its properties $4\frac{1}{2}$ miles north-east of the town. This mine was bought from Messrs. Pinard & Ducharme, and is turning out well. Some 300 men are employed. Mr. George Attwood, from England, is manager, and Mr. Ferguson assistant manager of this company.

Port Arthur District.

The chief event of late has been the visit of the Governor-General to the silver mines. Accompanied by Lady Stanley and suite he made a careful inspection of the various levels of the Beaver mine and noted the workings of the im-

proved machinery for extracting silver from the ore at the Badger mine. And from each of these mines the party were given magnificent specimens of the bronzed ore obtained. His Excellency expressed his delight at the great success attending the working of the mines and promised his hearty co-operation in any measures calculated to assist in developing a region more valuable than were it entirely of the richest agricultural character.

The advent of the American Institute of Mining Engineers to this district is hailed with pleasure. An inspection of the resources of this country by such an eminent and influential body who will see practically for themselves the mines, mills, developments, deposits, etc., will probably do more to bring us before the favourable notice of the public than all the cheap advertisements of people either directly interested in the mines themselves or who have raved about matters they imperfectly understood.

An engine, train of cars, and about twenty miles of rails for the new railway into the mining region is now on its way here, and the details of location, construction, etc., are being rapidly got into shape.

The silver mines are steadily and satisfactorily producing ore, some of which at great cost is still being shipped to England, Denver, New York, etc.

Large quantities of iron lands are still being sought after, chiefly by Americans and some of the low priced discoveries in silver are also changing hands at advanced figures.

In General.

The Sarnia Oil Company's pipe line is now at work conveying crude oil from the Petrolea district to the works in Sarnia, Ont. With the facilities of bringing in their supply of crude, the Sarnia Company is now in a position to go on steadily and regularly with the manufacture of their Northern Light brand of oil, claimed to be the best Canadian product on the market.

Statement of Silver Exported to United States from Port Arthur for six months ended 30th June last.

1889.	SILVER ORE.		BULLION.		TOTAL.
	Tons	\$	Oz. Try	\$	
January.....	1	1,050	.....	.....	\$1,050
February.....	18	25,200	3,900	3,900	29,100
March.....	.....	.....	.....	.....	.....
April.....	.....	.....	1,293	1,293	1,293
May.....	.....	.....	.....	.....	.....
June.....	12	15,000	.....	.....	15,000
Total.....	31	41,250	5,193	5,193	\$46,443

The World's Consumption of Charcoal.—According to Professor Winkler, the world's production of charcoal amounts to 360,000,000 tons annually, a quantity of charcoal equal in heating power to 1,640,000,000 cubic yards of newly felled pine wood. For this 2,600,000,000 pine trees, eighty years old, must have been cut, and must have occupied an area of 10,400 square miles. In a forest worked systematically, for this an area of 812,000 square miles would be necessary, an area four times that of the German empire.

Notes on the Ore Deposit of the Treadwell Mine.

(By Geo. M. Dawson, D.S., F.G.S.)

The Treadwell mine, situated on Douglas island, Alaska, is a somewhat remarkable ore-deposit, and has of late years become prominent as a producer of gold. I am not aware that any systematic description of the character of this deposit has yet been published, and this circumstance may render the following notes on its mode of occurrence of interest, while the microscopical examination of the gold-producing rock by Mr. F. D. Aeams, throws further light on the character of the deposit. My examination of the mine itself was made, by the kind permission of Mr. Treadwell, while I was on my way back from the Yukon district in the autumn of 1887.

Attention was first drawn to this deposit by the discovery of gold-placers, which were worked for several years previous to the finding of the ore, and in a few cases were found to pay well. The gold of the placers was fine, but rough and unworn in character. The placers occurred on the surface of the ore mass itself and on the rather steep slopes running down from its outcrop to the shore, and must have been produced by the natural decay of the ore subsequent to the glacial period, as they were found to lie above the boulder-clay, which fills many of the hollows and rests directly on the rock wherever it occurs. It may be noted here in passing, that Mr. Treadwell informed me that barnacles and various marine shells had been found still adhering to the surface of the rock, in places from which the clay had been excavated, up to a height of 150 feet above the present sea-level.

The ore-mass, which has been extensively exposed by stripping and proved as well by several drifts, has a thickness of about 400 feet. Its length, or at least the length of that part of it which will pay for working, is not accurately ascertained but must be considerable. It runs in a general northwesterly direction parallel to the shore of the eastern side of Douglas island and is bounded to the northeast and southwest by dark, rather than slaty argillites, which, from analogy with similar rocks which I have examined on the coast of British Columbia, to the southward, may very probably be of Triassic age and referable to the Vancouver series of the reports of the geological survey of Canada.* On the northeast side, in the immediate vicinity of the Treadwell mine, the ore-mass is bounded by a zone about seventy feet in thickness of greenish schistose slate, but it is uncertain whether this zone owes its character to peculiar alteration, or to a difference in original composition, as the slaty rock as a whole do not show any marked degree of alteration in the vicinity of the ore. A 'slate' horse more or less completely silicified is passed through in one place in the main working drift, but its character as a portion of the country rock is still clearly apparent. The argillites or slaty rock are often found to be flexed and tinted at high angles along this part of the coast, and it is probable that the main period of elevation of the coast ranges has been subsequent to that of their deposition.

The ore itself presents none of the characters of that of an ordinary lode or vein, being without any parallel banding or arrangement of its constituent minerals, and showing no such coarse crystalline structure as a lode of larger dimensions might be expected to exhibit. It is, on the contrary, a nearly homogenous crystalline mass, of medium grain, and pale grey in

*See Annual Report Geo. Sur., Can., 1886, p. 10 B.

colour, evidently consisting principally of quartz and white feldspar with a little calcite, and specked throughout with small cubical crystals of iron pyrites. The quartz, however, as well as the calcite and pyrites, may occasionally be found traversing the mass in small irregular veinlets and stringers, and the pyrites in some instances forms little distinct aggregations or bunches.

A clue to the true nature and origin of this deposit (otherwise of a somewhat similar enigmatical character), appears to be afforded by the existence in it, in some places, of kernels of a distinctly granitoid appearance. Some of these were observed to be six inches in diameter, and portions of others were found which may have had a diameter of several feet. The material of these kernels—which around their edges blend imperceptibly with the main mass,—is similar in size of grain to that of the ore-mass itself, but includes little or no pyrites. It is harder and less evidently decomposed, often greenish in tint from the development in it of chloritic minerals or reddish, and microscopically examined, shows two feldspars with some quartz. In general aspect it in fact resembles the varieties of fine grained granite which are frequently met with near the junction of an ordinary granite with other older rocks through which it has broken.

The impression formed from such examination of this remarkable deposit as I was able to make is, in fact, that it represents the upper portion, or "feather-edge" of a granite intrusion, probably contemporaneous and connected with the characteristic granites of the neighboring Coast Ranges, but which, owing to peculiar conditions, has become decomposed and silicified by solfataric or hydrothermal action, to which the concentration of gold in it and the deposition of pyrites, are also due. To what extent the presence of gold may depend on the occurrence of the adjacent slaty argillites, (elsewhere known to contain auriferous quartz-veins) it is impossible to say, but it appears not improbable that the deeper portions of these rocks may, under the action of such heated solvent waters, have afforded both the gold and the pyrites. It is conceivable that the hydrothermal action which has affected this part of the original granitic magma may have been due to the water included by the mass itself while in a state of "acqueo-igneous" or "granitic" fusion, the escape of such water through the substance of the upper part of the upper part of the intrusive mass being rendered possible by the relief from pressure consequent on the approach of the intrusion to the actual surface. It may, however, perhaps with greater probability, be supposed that the water included in the adjacent sedimentary deposits, became vaporized by the heat of the intrusive mass, and found its way to the surface in the form of steam through the substance of that mass. It will be noticed that Mr. Adams finds evidence in the microscopical character of the rock of much crushing and fracture, so that in any case it must have afforded a convenient channel for the passage of heated waters or steam, and this appears to have been one of the more important circumstances leading to its mineralization.

The slaty rocks themselves in the vicinity of the ore-deposit are traversed by numerous small veins of quartz; and at the distance of a few miles (on the mainland opposite Douglas island in "Silver Bow Basin") similar rocks are found to be cut by quartz-veins of greater width, which holds visible gold. The association of metalliferous quartz-veins with masses of granite or other intrusive rocks traversing sedimen-

tary deposits is a fact of general observation. Had the higher portions of the rocks, which may at one time have completely covered this particular granitoid intrusion, remained, it might be anticipated that it would be found to pass upward into one or more ordinary auriferous quartz-veins, these filling fissures through which the heated waters ultimately reached the then surface. In depth the present ore mass should be found, on the other hand, to pass gradually into ordinary unaltered granite. Many cases of course occur in which intrusive masses have led to the formation of metalliferous deposits of an intermediate character, such as the one here naturally exposed by subsequent processes of denudation appears to be. This deposit therefore affords an interesting example of the manner in which intrusive masses may directly give rise to ordinary metalliferous veins.

The quantity of gold contained in the ore of the Treadwell mine is small. Though not informed as to the actual yield, I believe it to be on the average less than \$10 to the ton. The ore is, however, easily and cheaply obtained by work resembling quarrying rather than mining, and can in consequence be profitably worked on a large scale. It is not intended here to enter into particulars as to the mode of working, but it may be stated that at the time of my visit 120 stamps were constantly employed, and that since that date this has been increased to 240, the quantity of ore milled daily being now reported at from 500 to 600 tons. A considerable proportion of the gold is "free" and this is saved on amalgamated plates. The remainder is contained in the iron pyrites, which is separated by Frue Vanners. The pyrites was then formerly roasted in revolving cylinders, but these were being replaced at the time of my visit by continuous automatic furnaces similar to those employed in sulphuric acid works. The gold is dissolved from the roasted product by chlorine gas, and precipitated by sulphate of iron.

As the geological conditions are very similar along the west coast all the way from Lynn canal to the strait of Fuca, it appears highly probable that other deposits of a similar character to that here described remain to be discovered. With the facts developed in connection with this mine in view it would appear to be well worth while to subject to examination and assay all pyritous and granitoid rocks in contact with or penetrating the sedimentary formations, and in particular those which may be found to traverse the slaty argillites of the formation above referred to as the Vancouver series.

Meeting of the British Columbia Smelting Company.

An extraordinary general meeting of the shareholders of the British Columbia Smelting Company was held during the month in London, Mr. W. J. Steele in the chair, to consider the present position of the company.

The chairman, after regretting the unavoidable absence of Mr. Birkin (one of their directors) and Mr. Tullis (the secretary), said it devolved upon him to read the notice convening the meeting, which he proceeded to do. Continuing, he said it would, no doubt, be in their recollection that on March 20th they held a private meeting of the principal shareholders, to lay before them the state of the company's affairs up to that date. At that meeting the directors gave them all the information in their power, and the shareholders unanimously resolved on the dismissal from the service of the company of Mr. George de Woolf, Mr. Dowling

and Mr. Davis. On the same day the board telegraphed to Vancouver to shut down the works and mine and discharge the men, except the local secretary, appointing only caretakers; and that was what was done as the result of the meeting of shareholders. Since that date every care had been taken of their property and machinery, which was thoroughly protected from the weather. It was also at the time considered necessary to obtain without delay an expert's report on the position of affairs; and on the recommendation of one of the large shareholders of the company, to whom he was personally known, the board authorised Mr. Judkins, of Leadville, Colorado, to proceed to Vancouver to report on the smelter and the mine and the prospects of the company, and desiring him to give any recommendations or suggestions he thought fit. Mr. Judkin's report was a very lengthy document and very exhaustive. The chairman then read a summary of the report, which referred to the general condition of the property, and pointed out that some £40,000 to £60,000 more capital was required to fully develop the mine and place the smelting operations on a sound footing. The directors had many anxious consultations on this report, and they thought it useless to try to raise the amount by a reconstruction of the company. They had had accounts made up, including the accounts from Vancouver, as far as that could be done. The figures were made up to about the end of May, since when very little had been done. The total amount of capital paid up was £23,580, and the amount they had on overdraft at Vancouver no doubt amounted to £7,400. That showed £30,980 funds entrusted to the company, which, he might tell them, had all, or nearly all, been spent. He then referred to the expenditure, pointing out that under the general charges were £358 for London expenses. Salaries and wages in British Columbia amounted to £6,496. Under the head of general charges was £1,000 paid to Mr. George de Woolf under an agreement between himself and Mr. Vautin, by which he received £1,000 when he left to take up the management of the property. Mr. Judkins' report had cost them about £250. The smelter had cost them £3,455, and other items made up the balance. They had 31½ acres of land which had a water frontage, and went back to the south of the Canadian Pacific Railway; five acres were on the north side of the line, and 38½ on the south side. This land was becoming very valuable. That on the north side of the railway was valued at 2,000 dols. per acre. The corporation of Vancouver were to make a street through a part of the land south of the line, which would make the land very much more valuable. Believing implicitly in the rapid and wonderful prosperity of Vancouver, he should say that almost any land in the city or adjoining it would become of very great value. A letter was read from Mr. Birkin, one of the directors, expressed the opinion that the failure of the company was due to Mr. Vautin having been entirely misled as to the value of the mines, and to his appointing Mr. G. de Woolf as manager while the local board had no control. Mr. Birkin thought there were only two courses open to them—to raise the money *pro rata* to pay off the mortgage, and then to wind up the company or sell it, or to take Mr. Judkins advice and raise £60,000 capital; but he did not recommend this course. The chairman then went on to refer to an action brought by Mr. G. de Woolf for wrongful dismissal and money due, which action was now *sub judice*.

A long discussion ensued, in the course of

which the chairman stated that the mortgage to the Bank of British Columbia falls due on the 10th inst. Ultimately it was decided to request the bank to extend the date, and the meeting was adjourned until the end of October. The report of Mr. Judkins and the statement of accounts in the meantime to be printed and circulated.

On the Microscopical Character of the Ore of the Treadwell Mine, Alaska.

(By Frank D. Adams, late of the Geological Survey of Canada.)

The material employed in this examination consisted of several small specimens kindly placed at my disposal by Dr. Geo. M. Dawson, who collected them at the Treadwell mine in 1887, together with two collected by R. G. McConnell, of this survey, who visited the mine when returning from the Yukon country last autumn. The ore is more or less altered granite, rather coarse in grain and of a light grey color. As mentioned by Dr. Dawson in the previous paper it encloses "kernels" often greenish in color and distinctly granitoid in appearance, having a diameter of from six inches to several feet. These are of the same grain as the rest of the mass, but are harder and less evidently decomposed, and pass rather sharply but imperceptibly into the ordinary grey granite. As these represent the granite in its least altered form they will be described first.

The Kernels.—One of the hand specimens shows a portion of one of these "kernels" which is seen to differ from the ordinary granite in two particulars: 1st, in being light reddish color instead of grey; 2nd, in being free from quartz veins and holding but little pyrite. When a thin section is held up against a dark background it is seen to be made up of numerous rather large translucent crystals or individuals closely packed together, but separated by narrow, transparent, intermediate lines. Under the microscope these translucent crystals are seen to be feldspar a good deal decomposed (which accounts for the opacity) while the intervening spaces are found to be in part grains of quartz or of broken feldspar and in part the edges of feldspar crystals, which are often much freer from decomposition products than their central portions.

Most of the feldspar is untwinned, and is referred to orthoclase. A much smaller amount, however, shows polysynthetic twinning, in a few cases two sets crossing at right angles, and is therefore plagioclase. In one of the sections a few large grains showing perthitic intergrowths were seen. Both feldspars often possess a marked zonal structure, caused or accentuated by the accumulation of decomposition products along certain concentric lines. Although many of the feldspar individuals extinguish simultaneously over their whole extent many others show the peculiar mottled extinction produced by pressure, while others again are distinctly seen to be in the act of breaking up into a mass of small grains. Both feldspars also, although having more or less perfect crystalline forms, are almost invariably broken into little grains around their edges, which gives them a somewhat rounded contour, the edges being often highly serrated. In addition to these feldspars the rock contains quartz, hornblende, epidote, ilmenite, sphene (?), apatite, hematite, calcite, chlorite and pyrite.

The quartz is present in rather small amount, and lies chiefly in corners or between the large feldspar individuals. It is uniaxial and positive, and shows an uneven extinction. Judging from its mode of occurrence, it is in great part

composed and show mechanical deformation, the at least a primary constituent of the rock. The hornblende occurs only in very small amount, and is not seen in all sections. It is pleochroic in light green and yellowish green tints, and is without good crystalline form, being somewhat fibrous in character, the extinction making an angle with the cleavage, for which the highest value observed was 17° . The epidote is present in small quantity, in irregularly shaped grains, or aggregates of grains, often associated with the hornblende. It shows the characteristic pleochroism, and is probably secondary in every case. Primary epidote does however occur in a similar, but unaltered mass of biotite granite, which is erupted through rocks of the same series as those cut by this granite on Wrangell Island, Alaska. (See appendix 5 B, Annual Report of the Geological Survey of Canada, 1887). A small amount of ilmenite or titaniferous iron ore is also found in the sections. It is opaque and black, sometimes having a slight reddish tinge by reflected light. In one case a few small grains were seen imbedded in broken feldspar. Each grain had been broken into several pieces, which lay close to one another, and were cemented together with a greyish material resembling leucocene, which is frequently observed associated with the iron ore in this rock. A few little flecks of hematite are seen as inclusions in the feldspar. The sphene and apatite are present in small amount, the latter being in rather short and stout crystals.

In addition to these minerals the rock contains remains of some mineral now replaced by aggregates of decomposition products which frequently present rather perfect oblong outlines, as if the original mineral had possessed a pretty good crystalline form. The principal constituent in these aggregates is calcite, which occurs in grains having the peculiar silvery white color usually exhibited by this mineral between crossed Nicols. Associated with it is chlorite, epidote, and often very small amounts of quartz, pyrite, and ilmenite of magnetite. In one of these masses a grain of light green somewhat fibrous hornblende was found filled with calcite grains and associated with epidote, chlorite and hematite. The mass appears originally to have been all hornblende, of which these other minerals are decomposition products, in fact all these aggregates probably represent original hornblende grains, chlorite, quartz, calcite and epidote being the minerals into which the hornblende of granites usually splits up in decomposing.

The examination of the "kernels" therefore shows that they are composed of a considerably crushed and altered granite, probably belonging to the class of hornblende granites.

The Ordinary Granite.—The grey granite which constitutes the mass of the rock and encloses the "kernel," in the hand specimen shows no perceptible foliation and is impregnated with pyrite and quartz, the latter occurring also in the form of little veins traversing the rock in various directions. The quantity of these minerals present however varies considerably in the different specimens. When examined under the microscope the rock is found to be composed of orthoclase, plagioclase, quartz, calcite, pyrite, with in some cases a very small amount of titaniferous iron ore and of some zeolite. Hornblende, chlorite, epidote and the other accessory minerals above mentioned were not found in any of the sections.

As in the case of the "kernels" the rock exhibits a very distinct cataclastic structure, induced apparently by crushing, but the crushing has gone much further in some cases than in others. Both feldspars are more or less de-

twin lines of the plagioclase being often bent and the crystals fractured and faulted transversely, and often presenting an appearance of having been shoved into one another. The individuals of both feldspars are usually surrounded by borders of broken grains from which arms of similar broken material frequently extend into the unbroken grains. In many other cases when the feldspars are examined between crossed Nicols they can be seen to be in the act of falling apart into a number of grains similar to those constituting the above mentioned borders. The orthoclase is present in larger amount than the plagioclase, but as in the case of the "kernels" the latter mineral is as a general rule rather better crystallized than the former.

Whether any of the quartz was an original constituent is a question which it is impossible to determine. A large amount of this mineral however is always present and most of it is of secondary origin, occurring in the rock in veins or in irregularly shaped masses. Small veins are found in all the specimens and are often seen sending off lateral arms into the rock. The quartz is clear and colorless and often contains lines of minute cavities. It is usually in large individuals, which although occasionally, especially in the narrow portions of the veins, show an uneven extinction, generally extinguish simultaneously over their whole extent. A considerable length of the vein is often composed of a single individual. The edges of the veins against the rock are well defined and the component grains come together along sharp lines without any of the interstitial broken material. Calcite often occurs associated with the quartz sometimes filling a portion of the same vein. In some cases it even preponderates over the quartz, forming the principal constituent of the vein. The quartz with its associated calcite is also seen in some sections in irregularly shaped masses, which, though pretty sharply defined against the more or less decomposed rock, at other times occur so that it is impossible to determine their exact limits owing to an impregnation of the rock about their edges, with the minerals of the vein. In these veins and masses both minerals occur in large grains. Very irregular-shaped masses of the calcite, also clearly secondary and often associated with pyrite are also found, especially in the crushed and broken portions of the rock. As before it occurs in large grains, frequently enclosing little bunches of a black, rod like mineral. Little isolated crystals of calcite also occur in a similar manner. The calcite does not occupy cavities into which the other minerals have crystallized but seems to have eaten its way into the feldspar, in some cases showing crystalline boundaries in the substance of the latter. Pyrite is present in considerable amount and is generally found well crystallized in little cubes. It occurs almost invariably in the crushed and broken portions of the rock and is very frequently associated with the calcite. In one slide, reproduced in figure 1, a mass of pyrite was observed enclosing a fragment of orthoclase, evidently a corner broken off from a large individual adjacent to it and with which its orientation was identical. In the figure the clear spaces show unbroken fragments of orthoclase separated by broken material, the result of crushing. A number of these small grains near the top of the cut, which are bounded by a somewhat heavier line, show one of the large fragments in the act of falling to pieces, a phenomenon which can be observed in most of the slides, when they are revolved between crossed Nicols. A number of the little cubes of pyrite are seen in the broken portion. After the corner of the large orthoclase individual had been

broken off, the pyrite was evidently deposited in the crack and around the detached fragment. The other little white spaces in the same pyrite mass represent little inclosures of quartz. These facts together with the occurrence of the pyrite almost exclusively in the crushing portions of the rock clearly prove the secondary character of this mineral.



FIGURE 1.

Section of the granite showing cataclastic structure with deposition of secondary pyrite. Magnified 32 diameters.

As it was a point of much interest to ascertain if possible the manner in which the gold occurred in the rock, the sections, twelve in number, representing five hand specimens very carefully examined by reflected light. In ten of them no trace of gold could be detected, but in the other two both from the same hand specimen, a few little bright yellow spots having exactly the color of gold could be distinctly seen in three of the pyrite grains. These spots were quite different in color from the pyrite, and easily distinguished from it. Figures 2 and 3 represent two of these grains of pyrite with their inclusions of gold. In order to make certain of the character of the yellow spots, the cover was removed from one of the sections and a portion of the section containing the grain of pyrite seen in figure 3 was

FIGURE 2.
Grain of pyrite holding inclusions of native gold, magnified 43 diameters.

removed to a clean glass slide and treated with hot concentrated nitric acid. The acid was found to dissolve away the pyrite with effervescence, leaving the bright yellow sponges of gold behind. The gold therefore occurs in part at least, in a free state and imbedded in the pyrite; no gold could be detected except in the pyrite. The zeolite mentioned as occurring in the rock is present in small amounts, and is not

FIGURE 3.
Grain of pyrite with inclusion of native gold.

seen in every section. It is evidently secondary, occurring in small irregular-shaped masses as a micro-crystalline aggregate. The individual grains were too small to allow its optical character to be determined. The cover was however removed from one section containing it, and the rock was treated with concentrated hydrochloric acid in

the cold for half an hour. On treating with fuchsine the aggregate was found to take up the coloring matter readily, showing that it had been decomposed by the acid, and is probably one of the zeolites.

It is a matter of difficulty to determine whether any cases of secondary enlargement are to be found in the sections. I believe however that in some cases the broken fragments have commenced to grow again by secondary deposition of material around their edges, although on account of the ragged character of the latter due to breaking away of fragments by crushing, it is very difficult in some cases to determine whether an irregular boundary is the result of crushing or of a secondary growth. The outline of some grains is very similar to that of a feldspar crystal showing secondary enlargement which is figured (Fig. 1, b.) in the preliminary notice of a paper on the Archean Geology of Missouri by Erasmus Haworth, (John Hopkins University Circulars, No. 65, April 1888). The feldspar of the rock is generally much clearer and more transparent along the borders of the veins and irregular masses of secondary quartz. In one case an individual of decomposed plagioclase was observed which was very clear and fresh where it approached a quartz grain. Both fresh and decomposed portions had the same orientation, and it is possible that the clear portion may have been an enlargement of the original grain.

In order to ascertain the character of the rock around the edge of the "kernels" where a transition between the two varieties might be looked for, two sections were cut from a small hand specimen one-half of which consisted of a portion of a "kernel" and the other of the usual grey granite. The granite near the "kernel" was found to resemble the ordinary granite in containing a considerable amount of pyrite though less than the more altered granite usually holds, as well as in the fact that all the hornblende and epidote, and practically all the chlorite has disappeared. A number of oblong forms were also to be seen, being of the same shape as those described in the sections of the "kernels" as probably decomposition products of hornblende. This rock however shows these in a still further stage of alteration, being now composed of an aggregate of calcite grains, often with a little pyrite and iron ore. The rock also contains some quartz, a portion of which occupies corners and is more or less broken and probably a primary constituent, while the rest occurs in a few irregular-shaped aggregations associated with calcite and pyrite in crushed portions of the rock and is secondary. The rock near the edge of the "kernels" therefore may be said to be intermediate in character between that of the "kernels" and the ordinary granite, but to resemble the latter more closely than that of the former. It is probable that some of the calcite masses found in the ordinary granite may be remains of the hornblende originally present but which have now to a certain extent lost their original shape owing to movements in the rock. It may therefore be stated that the ore of the Treadwell mine is a granite, probably belonging to the class of the hornblende granites, much crushed, altered and impregnated with secondary quartz, calcite and pyrite; that the "kernels" are portions of the rock in which alteration is less complete than in the mass of the granite and that at least a considerable portion of the gold present in the ore is contained in the pyrite as free gold.

A New Machine, designed by the Western Machine Works, Ottawa, is reported to be light, easily adjusted, and bore coal any thickness.

Gold-Milling in the Black Hills.†

(By H. O. Hofman, Rapid City, Dakota.)

With the exception of the exhaustive paper on the Father de Smet mill, by its designer, Mr. A. J. Bowie, Jr. (*Trans. x.*, 87), nothing, so far as the writer is aware, has as yet appeared on the stamp-mills of the Black Hills of Dakota, although they have been steady producers for the last ten years. Within the small area of about 6,000 by 1,600 feet, \$2,271,341.14 was produced in 1887 from rock averaging \$4.00 per ton in free gold.

I. THE ORES.

Character of the Ores.—The gold of the district is found in quartz and pyrites finely distributed through vast bodies of mica—and amphibole-schists, argillites and phyllites, and also impregnating the schists themselves. The "Belt," embracing the section of Lead City, Terraville and Central City, is the only part worked at present.

The principal associated mineral is iron pyrite, with some arsenopyrite and chalcopyrite, garnet and asbestos.

The ores from open cuts and upper levels are more free-milling than those from underground workings below water-line. Hence the mills running on oxidized ore have tailings as low as \$0.25 per ton, while tailings from unaltered ore run sometimes up to \$2.25 per ton. By watching the pulp when it flows down the plates it can be readily determined whether the ore comes from higher or lower levels. In the former case it will generally have a brownish red color, in the latter a bluish gray. The amount of free gold in the ores varies, therefore, with the depth at which they are mined. It is difficult to give a correct average figure of its value, but \$4 per ton will be near it.

The total value of the ore is not definitely known, as its weight is not actually determined, but only estimated, and regular dry assays are not made at all.

To determine the amount of free gold in the ore, the following method is in practice: Samples are taken daily from the different workings in the mine and sent to the "sampler," who crushes them, pans them and estimates the gold in the pan. Every valuation thus made is booked, and at the end of the month the average is taken and compared with the output of the mill, and the amount of gold recovered thus approximately determined. The mode of operation practiced by the "sampler" is simple: The sample, weighing, say ten pounds, is emptied into a 4-gallon bell-shaped mortar (13½ by 12½ inches) and crushed to nut-size with a heavy pestle, swung from a spring-pole. From it two pounds are then transferred into a second mortar of the same size, with a wooden lid, and there pulverized wet to a fine pulp, by means of a small steam-stamp, which is in reality an old power-drill, fitted up for this purpose. When sufficiently fine (as judged by the ring of the pounding stamp), the pulp is panned until all pyrites and other heavy sands are washed off with the tailings, and only the free gold remains. The "sampler" of the Homestake company pans from fifty to fifty-five samples per day. Great skill is acquired in thus estimating the value of the ore, the sampler being able to make from eight to ten valuations an hour.

As these are the only determinations made, it can be readily seen that the amount of the non-free-milling gold which enters the mill is not known. The percentage of sulphurets has been determined in several instances, and varies

† Amer. Ins. M. E., New York Meeting, February, 1889.

from 2½ and 3 per cent. to 6 and even 10 per cent. The assay-value of pure concentrates, freed from rusty gold or gold that is still enclosed in quartz (the ore being not sufficiently crushed), has lately been shown to vary from \$4 to \$90 per ton, the average for the district being about \$25 per ton.

Sorting of the Ore.—As the gold is finely disseminated throughout the entire vein-matter, comparatively little sorting in the mine can be expected. There occur, however, in many parts of the veins, igneous intrusions, locally called "porphyry," which form "barren horses." When the Nevada system of timbering in square sets was exclusively in use, no distinction was made between mill-rock and waste, but it was considered that the cheapest way to get rid of the latter was to run it through the mill. Lately, however, it has become the custom to fill the chambers formed by this timbering with waste rock and to hoist any excess of it to the dump, thus sending less waste through the mill; but large quantities are still got rid of in the old way, by running through the mill; but large quantities are still got rid of in the old way, by running the mill.

II. ENUMERATION OF MILLS.

When in 1876 the auriferous gravels and lodes were discovered, there was a "rush" to the Black Hills, and in a very short time a large number of mills sprang up. Of these the seven named in the following tables are still running with 640 stamps.

TABLE I.—LIST OF STAMP-MILLS.

Name of Mill.	Year of Erection.	Location.	Name of Company.	No. of Stamps.
Homestake.....	1878	Lead City,	Homestake Mining Co.,	80
Golden Star.....	1879	"	"	120
Highland.....	1880	"	"	120
Deadwood.....	1879	Terraville,	Deadwood-Terra Ming Co.	80
Golden Terra.....	1880	"	"	80
Father de Smet.....	1878	Central City,	Father de Smet	100
Caledonia.....	1879	Terraville,	Caledonia	60

The 25-stamp custom mill, the "Cassel" mill, which was built at Central City, about the same time as these, is running principally on cement gravel and will not be discussed here.

Although the mills given in the foregoing table are owned by five separate companies, they are all, except the last, under the management of the Homestake superintendent. Thus it follows that the working details of the six mills are all, as far as practicable, after one model—the Homestake. The Caledonia mill stands alone, and works on a very different rock. Therefore the details of its plant differ considerably from those of the others.

III. OUTLINE OF PLANT AND PROCESS.

The crushing is done by means of rock breakers and stamps. The breakers reduce the coarse ore to a size suitable for the stamps. The ore, arriving at the highest level of the mill (the ore-floor) in mine cars, is discharged from the side or bottom of the car (dumping and bottom-discharge cars being both in use) over grizzlies to the crusher floor; or it goes directly to the crusher-hopper. The small ore-particles, passing through the grate of the sizing screen, and the coarse ore (which has been reduced in size by the crushers), both drop into the same ore-bin, which reaches down to the cam-floor. Here a number of chutes deliver it to the automatic feeders, each of which discharges its contents continuously into the mortar to which it belongs. Here the ore is pulverized by stamps (five in each mortar) lifted at regular intervals by corresponding cams, which are keyed to a cam-shaft, placed in front of the battery on the cam-floor. Water is fed continuously into the mortars, and forms, with the ore, a liquid pulp, which passes through a screen at the front on to and over the apron-plates on the lower floor of the building. The Caledonia mill has blankets on the lower end of these plates to catch any coarse heavy particles; in the other mills the pulp passes directly from the apron-plates to the mercury-traps and through them on to sluice plates. From the traps, placed at the end of these, the pulp runs into one main sluice which may again have one or more traps before the pulp is finally allowed to run to waste.

Thus the entire process of passing the auriferous coarse rock from the ore floor to the final discharge, at the end of the main sluice, is an automatic one.

Battery amalgamation is used to extract the gold. It begins in the mortar, where mercury is added at intervals (while the continuous fine crushing with the stamps is taking place) and ends on the apron-plates, where nearly all the amalgam not retained by the inside amalgamated copper plates is collected daily, any deficiency in the collecting mercury and amalgam on the plates being supplemented by the various traps.

As the mills on the "Belt" have to treat low-grade ores, it is necessary to their profitable operation that large amounts should be put through as rapidly as may be, and that, at the same time, as much gold as possible should be saved by simple means. To effect this, a compromise is made between the two extreme methods of gold-milling. One of these aims at extracting as much gold as possible in the battery at the expense of capacity; the other, by amalgamating outside of the battery, increases the crushing capacity, but requires a number of expensive operations to recover the gold. In the Black Hills, amalgamation is carried on both inside and outside the battery, thus combining the simple way of recovering the gold from the first method with the large capacity of the second. The aim is to crush rapidly to the desired fineness and arrange the amalgamation so that it shall be adapted to the large amount of pulp produced.

IV. GENERAL FEATURES OF THE MILLS.

Table 2 gives a comparative view of the dimensions, power, batteries, and product of the mills. The following is an explanation of the letters employed in this table:

A, Horizontal 155 H.P. engine, with Meyers cut-off. B, 300 H.P. Harris-Corliss engine. C, 350 H.P. Corliss engine, Fraser and Chalmers pattern. D, two 60 H.P. horizontal engines, with automatic cut-off; one driving forty

stamps, the other now driving twenty, but soon to drive twenty more now erecting.

a. Length and width are always of mill proper, excluding engine-room.

b. The boilers in this table are all horizontal, tubular, 54 in. diameter, 16 feet long, with 46 tubes of 3½ in. diameter. Steam pressure is kept at 90 lbs. per sq. in.

c. Made up as follows: Wrought iron stem (length 14 ft., diameter 3½ in.) 340 lbs.; cast-iron head (height 18 in., diameter at top 9 in., at bottom 8 in.) 240 lbs.; cast-iron shoe (cylindrical but 8 in. high and 8¼ in. diameter, tapering shank 4½ in. diameter at base, 3½ in. at top, 5 inch high—the shoe being made of white iron, chilled for 6½ in. from base, the next 1½ in., and the shank being cast in sand and cooled slowly), 140 pounds; cast-iron gib-tappet diameter at ends 9¼ in., in middle cylindrical part 6 in., wearing faces 2½ in. thick, middle part 7 inches long, total length 12 in.), 130 lbs. Total, 850 lbs., stem, head, shoe, and tappet being proportioned as 34 : 24 : 14 : 13.

d. Batteries in two rows, back to back, leaving this space between the rows for ore-bins and feeders.

e. From June 1, 1887 to May 30, 1888, inclusive.

f. Estimated from report of Homestake Co. June, 1888, where product of 200 stamps in Homestake and Golden Star mills (under same management and similar conditions) is given as 243,355 tons for the year ending May 30, or 1,216,775 per stamp.

g. See Report of the Director of the Mint for 1887.

h. Will be increased to 20 in., as 18 in., which was large enough for 60 stamps, is not enough for 80.

i. Formerly 12, the mill having been originally built for 60 stamps.

k. Batteries in single line.

l. Batteries in two rows, but face to face, with this space between them.

m. Intentionally slower crushing on harder rock than the other mills.

n. For year ending April 30, 1883.

o. Excluding some concentrates from preceding year.

Distribution of Power—The methods employed in transmitting power from the engine to the different parts of the mill may be classed under three types, represented respectively by the Homestake, Golden Star and Highland mills. The Caledonia may be placed with the Golden Star, and the Deadwood, Golden Terra, and Father de Smet, with the Highland, notwithstanding local variations, especially such as are necessitated in the Father de Smet by the peculiar arrangement of its batteries.

1. In the Homestake mill, the continuation of the engine-shaft forms the line-shaft of the mill and is placed on the battery sills. This is a cheap construction and gives a solid foundation for the boxes, in which the line shaft rests. The shaft is kept in line by the even pull of the long belts placed on each side at an angle of about 30 degrees. The supposed disadvantage at being obliged to stop the entire mill, if anything happens to the line-shaft, is insignificant. When the mill was built in 1878, the line-shaft was not made of sufficient thickness, in consequence of which it became twisted and broke within two years. The new shaft, having the requisite strength, has been steadily in use ever since. For minor repairs, the position of the shaft is a disadvantage. It is in an obscure place where it escapes attention, particularly as everything has to be done by artificial light.

(To be Continued.)

Canadian Mines on the English Market.

	Price Per Share	
General Mining, Limited £219,752 fully-paid shares of £8	4 3/4	4 3/4
Low Point, Barrasois and Ligan, \$309,100 fully-paid shares of \$100.....	5 3/8	7 1/2
Ditto, \$200,000 vendors fully-paid shares of \$100.....	—	—
North Western Coal and Navigation, Limited, £160,500 6 per cent. debentures; coupons June 30 and Dec. 31; principal 1904.....	—	—
Ditto £149,500 fully-paid ordinary shares of £10.....	—	—
Ditto £900 fully-paid deferred shares of £100.....	—	—
Sydney and Louisburg Coal and Railway, Limited, £50,000 cumulative 10 per cent. first preference shares of £10, £6 paid.....	7 1/2	8 1/2
Ditto £14,560 fully-paid non cumulative 6 per cent. second pref. of £10.....	3	—
Ditto £250,000 fully-paid ordinary shares of £10.....	1	—
New Vancouver Coal Mining and Land Co., Limited, £185,000 fully-paid shares of £1.....	5/8	7/8
Excelsior Copper, Limited, fully-paid shares of £1.....	—	—
Ditto, shares of £1, 17s. 6d. paid.....	—	—
Shuniah Weachu, Limited, £39,888 fully-paid shares of £1	3/8	1/2
Silver Wolverine, Ltd., £68,465 fully-paid shares of £1...	—	—
Anglo-Canadian Asbestos, Limited, £39,132 fully-paid shares of £2.....	—	—
Anglo-Canadian Phosphate, Limited, £46,340 fully-paid pref. shares of £10.....	—	—
Ditto, £15,050 fully-paid deferred shares of £10.....	—	—
British Columbia Smelting, Ltd., £25,000 preference shares of £1, 10s. pd.....	—	—
Ditto £100,000 fully paid ordinary shares of £1.....	—	—
Canadian Phosphate, Ltd., £100,000 fully paid shares of £1.....	1/8	3/8
Bell's Asbestos, Limited, £100,000 fully paid shares of £5.....	18 3/4	19
White's Asbestos, Limited, £20,000 fully paid shares of £1.....	—	—
Ditto shares £1 paid.....	—	—
Jackson Rae Phosphate Co., Limited, \$25,000 fully paid shares of \$1.....	—	—
Western of Canada Oil, Limited, £200,000 fully-paid shares of £100.....	—	—
Ditto £99,850 fully-paid shares of £50.....	—	—
Ditto £199,700 12 per cent. debentures of £100.....	—	—

General Mining.—Accounts to December 31 submitted in April, but an interim meeting is held in November. Dividend for 1884, 5 per cent; for 1885 and 1886, 3 1/2 each year; and for 1887, £4 13s. 9d. per cent. Reserve fund, £29,850.

Low Point.—The vendors' shares, up to the end of 1888, do not rank for dividend until 7 per cent. per annum dividends have been paid on ordinary. Accounts to Dec. 31. For 1887, 5 per cent. was paid on the ordinary shares other than those held by the General Mining Assoc., that Company foregoing their dividend rights.

North-Western Coal.—The deferred shares receive on dividend until 15 per cent. per annum (cumulative) has been paid on the ordinary. Accounts to June 30. Dividend for 1887-3, 5 per cent.

Sydney and Louisburg Coal.—Accounts to Dec. 31 submitted about May. Out of the profits of 1884 one half-year's dividend on the first preference shares was paid. No dividend since. Debit to Dec. 31, 1887, £1,574.

Vancouver Coal.—Accounts to June 30 and December 31 submitted in November and May. In the half-year to June, 1888, there was a net profit of nearly £11,000. Debentures, £57,200. Reconstruction has been decided on.

Excelsior Copper.—Registered September 26, 1888. Authorized capital, £450,000; purchase consideration, £400,000, in cash or shares. Fully-paid shares issued to the vendor; partly paid to the public.

Shuniah Weachu.—Accounts to Nov. 20 submitted in February. No dividend yet.

Silver Wolverine.—Registered October 19, 1888, with a capital of £100,000, of which £80,000 was the first issue. Most of the shares were issued to the vendor.

Anglo-Canadian Asbestos.—The Company was registered in November, 1885. Accounts to October 31 submitted in March. No dividend yet. Debentures, £3,450. Reports are not obtainable, being reconstructed.

Anglo-Canadian Phosphate.—The preference shares rank first for 7 per cent., and after a like rate has been paid on the deferred shares, both classes rank equally.

British Columbia Smelting.—The company was registered May 9, 1888. The ordinary shares were issued to the vendor, and they do not rank for dividend until the preference shares have received dividends amounting to 100 per cent.

Canadian Phosphate.—Accounts to November 30 submitted in February. Eleven months to Nov. 30, 1888, resulted in a profit of £2,576, which was carried forward.

White's Asbestos.—Registered April 9th, 1889. the authorised capital is £100,000; first issue, £60,000, of which £20,000, fully paid, was issued to the vendor.

Jackson Rae Phosphate.—Registered May 9, 1889.

Western of Canada Oil.—Accounts to March 31 submitted in May. Debenture interest is not paid. In 1886-7 there was a profit on working of £256; in 1887-8 of £690; and in 1888-9 of £1,279. Debit balance on March 31, 1889, £900. A loan of £8,400 has been obtained on the security of £30,000 B debentures.

Rapid Driving of a Cross-Cut.—A Tschebull, in a paper read before the Austrian Society of Engineers and Architects, describes the method which was employed in lignite mining near Gran in Hungary, in a case in which it was necessary to open up some lignite beds as rapidly as possible. Hand-boring was alone possible, and the question was how to proceed with the greatest rapidity in the driving, the formation being Eocene slaty sandstones and shale, and Triassic limestone. A shaft had been sunk to a depth of about 330 feet, and this had afterwards filled with water for about half its depth. A cross cut was then made, which commenced just above the water level, the progress made in Eocene rocks during the first month having been 159 feet. The author describes the arrangements made with a view to expedite the cross-cutting, the division of labour and the method of payment for work done. To enable the material brought down by the shots to be cleared away with greater rapidity, one or two flat pieces, of stout sheet-iron, about 6 1/2 ft. x 3 1/4 ft., were placed before the bore-holes previous to firing. Most of the rock brought down by the shots remained on these sheets, and was much more readily removed from them than would have been possible if the bed had consisted of the rough floor of the level. In the eight hours' shift the division of time was as follows:

Putting in the bore-holes.....	5 1/2 hours.
Charging and firing.....	1 " "
Allowing smoke to clear away.....	1/2-3/4 " "
Clearing the level, &c.....	3/4-1 1/2 " "

THIS SPACE
TO LET

THE DOMINION WIRE ROPE CO.

MANUFACTURERS OF



Works at LACHINE.

For Hoisting, Mining, Transmission of Power, Towing
Ship Rigging, Guys, etc.,

ALSO

Lang's Patent Wire Rope for Transmission and Colliery Purposes.

JAMES COOPER, Agent, Montreal.



MONEY ORDERS.

MONEY ORDERS may be obtained at any Money Order Office in Canada, payable in the Dominion; also in the United States, the United Kingdom, France, Germany, Italy, Belgium, Switzerland, Sweden, Norway, Denmark, the Netherlands, India, the Australian Colonies, and other countries and British Colonies generally.

On Money Orders payable within Canada the commission is as follows:

If not exceeding \$4.....	2c.
Over \$4, not exceeding \$10.....	5c.
" 10, " " 20.....	10c.
" 20, " " 40.....	20c.
" 40, " " 60.....	30c.
" 60, " " 80.....	40c.
" 80, " " 100.....	50c.

On Money Orders payable abroad the commission is:

If not exceeding \$10.....	10c.
Over \$10, not exceeding \$20.....	20c.
" 20, " " 30.....	30c.
" 30, " " 40.....	40c.
" 40, " " 50.....	50c.

For further information see OFFICIAL POSTAL GUIDE.

Post Office Department, Ottawa.
15th Sept., 1888.

LEDOUX & COMPANY,

10 CEDAR ST, NEW YORK,

Engineers, Metallurgists &
Assayers.

Public Ore Sampling & Storage Works

All the principal buyers of furnace materials in the world purchase and pay cash against our certificates of assay, through New York banks.

By special permission of the Secretary of the Treasury of the United States, cars of ore or copper matte passing through in bond can be opened and sampled at our works.

Consignments received and sold to highest bidder. Send for circular giving full particulars.

Mines examined and sampled. Assays and Analyses of all kinds.

MINERS OF NOVA SCOTIA!

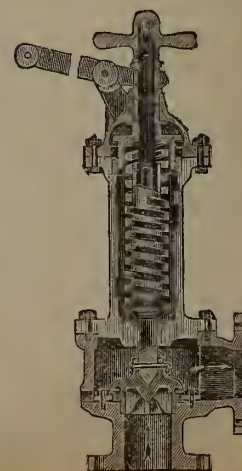
W. & A. MOIR,

MECHANICAL

Engineers and Machinists,
HALIFAX.

Manufacturers of

Mill and Mining Machinery,
Air and Circulating Pumps,
Hand and Power Elevators,
Marine & Stationery Engines,
And Brass and Iron Castings
of every description.



CRUDE AND MANUFACTURED FOR ALL PURPOSES.



Cloths, Facings, Furnace Cements, Paper, Stove Linings, &c.

SPECIALTIES: FIRE-FELT, a flexible Asbestos Sheet, made in tubular sections and rolls, best and most durable non-conductor made. SUPERATOR, a strong fire & waterproof fabric for sheathing & roofing buildings, fire proofing boiler rooms, &c.

THE CHALMERS-SPENCE CO.,

419 TO 425 EIGHTH ST., NEW YORK

ASBESTOS.

RUSSELL & CO.

PROVINCIAL AND DOMINION

LAND SURVEYORS,

CIVIL AND MINING ENGINEERS,
PORT ARTHUR, ONTARIO.

Mining Properties Surveyed, Reported on and Dealt in

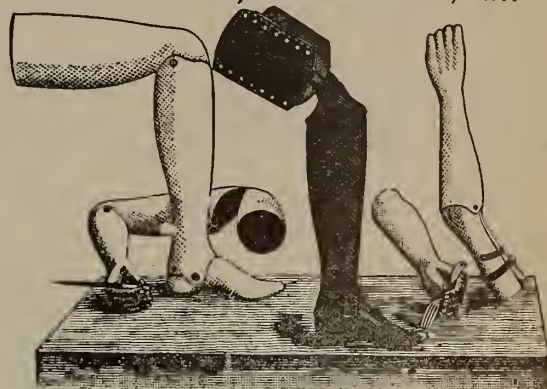
Latest and Most Complete Plans of Thunder Bay
Mining District Always on Hand.

A. L. RUSSELL, A. H. MACDOUGLL, W. W. RUSSELL
P. L. S., D. L. S. P. L. S., D. L. S. M.E.A.MCAN.SOC.C.E

PROPERTIES FOR SALE.

Parties having developed or undeveloped mineral lands for sale will find the REVIEW an admirable medium for bringing them before the notice of CAPITALISTS and INVESTORS in GREAT BRITAIN and the UNITED STATES.

BEACOCK & CO., - - BROCKVILLE, ONT.



—Manufacturers of—

Rawhide, Artificial Limbs & Splints

Patented in the United States and Canada. Send for prices.

Gold Mining Machinery.



I. MATHESON & CO.,

Engineers and Boilermakers,

NEW GLASGOW, N.S.

TAURO FOUNDRY AND MACHINE CO.

TRURO, N.S.

Engineers & Founders

OUR SPECIALTIES

— ARE —

Gold Mining Machinery

Of every kind, with latest Western Improvements.

ROTARY SAW MILLS

In Latest Styles.

ALSO MANUFACTURERS OF
BOILERS & ENGINES

Iron, Bridges, Stoves,

SHIP, MILL and GENERAL
CASTINGS.



G. CLISH,
Manager.

D. McDONALD,
Supt.

S. R. TUPPER,
Sec'y and Treas

WM. STAIRS, SON & MORROW,

174 to 190 Lower Water St., Halifax, N.S.,

Importers and Dealers in all kinds of Mining Supplies, Steel Wire Ropes,

LUBRICATING OILS, EXPLOSIVES, &c. &c.

Correspondence solicited. Goods promptly supplied. Sole agent for Canada for Patent Mineral Fusible Cement.



PROVINCE OF NOVA SCOTIA.

Leases for Mines of Gold, Silver, Coal, Iron, Copper, Lead, Tin — AND — PRECIOUS STONES.

Titles given direct from the Crown, Royalties & Rentals moderate

GOLD AND SILVER.

Under the provisions of chap. 7, Revised Statutes, of Mines and Minerals Licenses are issued for prospecting Gold and Silver for a term of six months, which can be extended by renewal for another six months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. Up to five areas the cost is 50 cents per area, for every area in addition 25 cents. Cost of renewal one half the original fees. Leases of any number of areas are granted for a term of 21 years. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents annually for each area contained in the lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at \$19.00 an ounce, and in smelted Gold valued at \$18.00 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province he may stake out the boundaries of the area he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for twelve months are issued, at a cost of twenty dollars, for Minerals other than Gold and Silver, out of which one square mile can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department free of charge, and provision is made for lessees and licensees whereby they can acquire promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists who have always stated that the Mining Laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are :—Copper, four cents on every unit ; Lead, two cents upon every unit ; Iron, five cents on every ton ; Tin and Precious Stones, five per cent. ; Coal, 7½ cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

THE HON. C. E. CHURCH,

Commissioner Public Works and Mines,

HALIFAX,

NOVA SCOTIA.

VALUABLE PLUMBAGO

AND OTHER

Mineral Lands FOR SALE,

IN THE TOWNSHIP OF BUCK-
INGHAM, COUNTY OF
OTTAWA.

1st.—Lot 28, in the 6th range, containing 100 acres, in addition to the salina of the lake.

2nd.—North half of lot 23, in the 5th range, containing 100 acres.

3rd.—Nine acres of lot No. 23, in the 5th range, with water privileges thereto appertaining, being site of mill dam, etc., etc.

The property formerly belonged to the Montreal Plumbago Mining Company, and was worked successfully for several years, until the company's mill was destroyed by fire, but the mill dam remains almost uninjured, and there are on the property several houses, sheds, etc., built for various purposes when mining operations were carried out.

The Plumbago Deposits

upon the property are regarded as amongst the richest and most extensive in the Dominion. As to the quality of the Plumbago, it has been extensively used in the manufacture of crucibles, lubricating leads, stove polish, etc., etc., and given unbounded satisfaction. This is established by the experience of consumers, and by a certificate from the celebrated Battersea Crucible Works, London, England, a copy of which is open for inspection.

MICA

has also been discovered in quantity

The lands are in the Phosphate region, and recent prospecting has disclosed a rich and extensive deposit of this mineral. There are unrivalled facilities for transporting the ore to and from the mines by the Ottawa River and C. P. Railway. Distance from mines to Railway Station 6 miles. Good road.

All that is required to make these valuable mines handsomely remunerative is a little capital and enterprise.

The Title is Indisputable.

For information apply to

WM. H. DICKSON,
160 Waller St., Ottawa.

H. E. DICKSON,
Russell House, Ottawa.

OR TO THE OFFICE OF

THE CANADIAN MINING REVIEW.

OTTAWA,

SHIPMAN ENGINES, ACME MODEL.

COAL OIL FOR FUEL.



To parties requiring a safe, reliable, durable and economical Steam Launch, from 20x4 to 35x7 with ample power to give satisfactory speed can supply the best on the market and at prices which will defy competition for a like quality of goods. We have a full staff of competent boat and engine builders and guarantee every article to be strictly first class. Hundreds of our engines from 1 to 12 h. p. Marine or Stationary have been in use for years and are acknowledged superior to all others. No smoke, dirt or sparks, no manual or mechanical labor necessary. You have the privacy of your launch for your family. As the water and oil supply is automatic very little attention is required. But a few minutes is necessary to get up 100 lbs. of steam; when you return to the boat house by turning a hand wheel all fire is extinguished. Orders for coming season should be placed at once, as the demand is much in excess of previous years. Write for 1889 circulars giving prices, testimonials, etc. No attention paid to postal cards.

JOHN GILLIES & CO., Carleton Place, Ont.

JOHN A. ROEBLING'S SONS CO. WIRE ROPE

—FOR—

Mines, Elevators, Inclines, &c.

GALVANIZED GUY ROPE. BRIDGE CABLES.
HAWSER ROPES.

WIRE of all kinds. Insulated WIRES

John A. Roebling's Sons Co.

117 & 119 LIBERTY St., NEW YORK.

H. L SHIPPY Sec'y.

PHOSPHATES, PHOSPHATIC MANURES, AGRICULTURAL FERTILIZERS

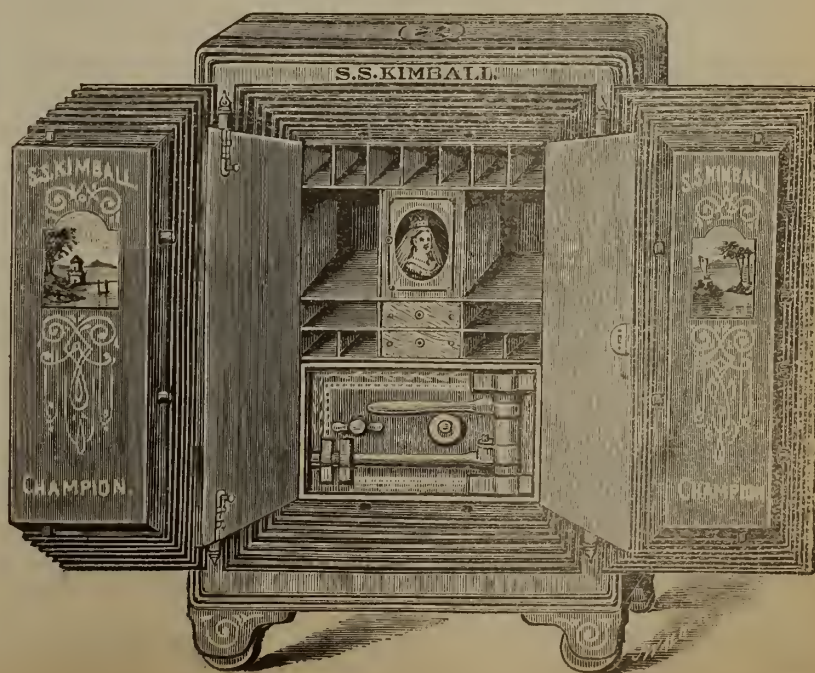
Readers of the REVIEW desiring extra copies of SCIENTIFIC AGRICULTURE should SEND IN THEIR ORDERS NOW. A few SPACES are still open and contracts may be made at reasonable rates. Address Manager, THE CANADIAN MINING REVIEW, OTTAWA.

Champion Fire and Burglarproof Safes.

These Safes have the best record of any in the Dominion. Price 30 per cent. cheaper than any other first-class Safe.

SEND FOR CATALOGUE AND PRICE-LIST.

S. S. KIMBALL,
577 Craig St., Montreal.





DEPARTMENT OF Inland Revenue.

AN ACT RESPECTING AGRICULTURAL FERTILIZERS.

The public is hereby notified that the provisions of the Act respecting AGRICULTURAL FERTILIZERS came into force on the 1st of January, 1886 and that all Fertilizers sold thereafter require to be sold subject to the conditions and restrictions therein contained—the main features of which are as follows:

The expression "fertilizer" means and includes all fertilizers which are sold at more than TEN DOLLARS per ton, and which contains ammonia, or its equivalent of nitrogen, or phosphoric acid.

Every manufacturer or importer of fertilizers for sale, shall, in the course of the month of January in each year, and before offering the same fertilizer for sale, transmit to the Minister of Inland Revenue, carriage paid, a sealed glass jar, containing at least two pounds of the fertilizer manufactured or imported by him, with the certificate of analysis of the same, together with an affidavit setting forth that each jar contains a fair average sample of the fertilizer manufactured or imported by him; and such sample shall be preserved by the

Minister of Inland Revenue for the purpose of comparison with any sample of fertilizer which is obtained in the course of the twelve months then next ensuing from such manufacturer or importer, or collected under the provisions of the Adulteration Act, or is transmitted to the chief analyst for analysis.

If the fertilizer is put up in packages, every such package intended for sale or distribution within Canada shall have the manufacturer's certificate of analysis placed upon or securely attached to each package by the manufacturer; if the fertilizer is in bags, it shall be distinctly stamped or printed upon each bag; if it is in barrels, it shall be either branded, stamped or printed upon the head of each barrel or distinctly printed upon good paper and securely pasted upon the head of each barrel, or upon a tag securely attached to the head of each barrel; if it is in bulk, the manufacturer's certificate shall be produced and a copy given to each purchaser.

No fertilizer shall be sold or offered or exposed for sale unless a certificate of analysis and sample of the same shall have been transmitted to the Minister of Inland Revenue and the provisions of the foregoing sub-section have been complied with.

Every person who sells or offers or exposes for sale any fertilizer, in respect of which the provisions of this Act have not been complied with—or who permits a certificate of analysis to be attached to any package, bag or barrel of such fertilizer, or to be produced to the inspectors to accompany the bill of inspection of such inspector, stating that the fertilizer contains a larger percentage of the constituents mentioned in sub-section No. 11 of the Act than is contained therein—or who sells, offers or exposes for sale any fertilizer purporting to have been inspected, and which does not contain the percentage of constituents mentioned in the next preceding section—or who sells or offers or exposes for sale any fertilizer which does not contain the per-

centage of constituents mentioned in the manufacturer's certificate accompanying the same, shall be liable in each case to a penalty not exceeding fifty dollars for the first offence, and for each subsequent offence to a penalty not exceeding one hundred dollars. Provided always that deficiency of one *per centum* of the ammonia, or its equivalent of nitrogen, or of the phosphoric acid, claimed to be contained, shall not be considered as evidence of fraudulent intent.

The Act passed in the forty-seventh year of Her Majesty's reign, chaptered thirty-seven and entitled, "*An Act to prevent fraud in the manufacture and sale of agricultural fertilizers*," is by this Act repealed, except in regard to any offence committed against it or any prosecution or other act commenced and not concluded or completed, and any payment of money due in respect of any provision thereof.

A copy of the Act may be obtained upon application to the Department of Inland Revenue, as well as a copy of a Bulletin which it is proposed to issue in April, 1888, concerning the fertilizers

E. MIALL,
Commissioner.

January, 1889.



NOTICE

Is hereby given that all communications in respect to matters affecting the Department of Indian Affairs should be addressed to the Honorable E. Dewdney as Superintendent General of Indian Affairs, and not as Minister of the Interior, or to the undersigned. All Officers of the Department should address their official letters to the undersigned.

L. VANKOUGHNET,
Deputy Superintendent-General
of Indian Affairs.

Department of Indian Affairs,
Ottawa, 17th May, 1889.



Intercolonial Railway OF CANADA.

The direct route between the West and all points on the St. Lawrence and Baie des Chaleur, Province of Quebec; also for New Brunswick, Nova Scotia, Prince Edward, Cape Breton and the Magdalene Islands, Newfoundland and St. Pierre.

EXPRESS TRAINS leave Montreal and Halifax daily (Sunday excepted) and run through without change between these points in 30 hours.

The Through Express Train cars of the Intercolonial Railway are brilliantly lighted by electricity and heated by steam from the locomotive.

New and Elegant Buffet Sleeping and Day Cars are run on all through Express Trains.

The popular Summer Sea Bathing and Fishing Resorts of Canada are along the Intercolonial, or are reached by that route.

CANADIAN EUROPEAN MAIL AND PASSENGER ROUTE.

Passengers for Great Britain or the Continent by leaving Montreal on Thursday morning will join Outward Mail Steamer at Rimouski the same evening.

The attention of shippers is directed to the superior facilities offered by this route for the transport of flour and general merchandise intended for the Eastern Provinces and Newfoundland; also for shipments of grain and produce intended for the European market.

Tickets may be obtained and all information about the route, also Freight and Passenger rates, on application to

G. W. ROBINSON,
Eastern Freight and Passenger Agent,
137½ St. James St., MONTREAL.

E. KING,
27 Sparks Street,
OTTAWA.

D. POTTINGER,
Chief Superintendent.

Railway Offices, Moncton, N.B.
2nd July, 1889.

The Polson Iron Works Co'y TORONTO, ONT.

Manufacturers of the Celebrated "Brown Automatic Engine."

GENERAL DEALERS IN

MINING MACHINERY.

SPECIAL AGENTS FOR

Knowles' Steam Pumps,

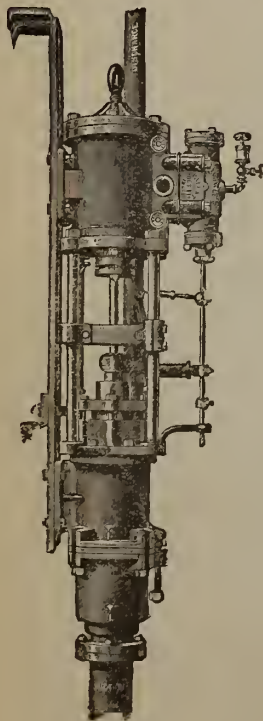
B. T. Sturtevant's Blowers and Fans,

Burleigh Rock Drills.

Hoisting Engines and Boilers, Quartz Mills, Diamond Prospecting Drills, Rock Breakers.

Office and Works, Esplanade E.; Warehouse, 38 Yonge St.,

TORONTO.





Mining Regulations

TO GOVERN THE DISPOSAL OF

Mineral Lands other than Coal Lands, 1886.

THESE REGULATIONS shall be applicable to all Dominion Lands containing gold, silver, cinnabar, lead, tin, copper, petroleum, iron or other mineral deposits of economic value, with the exception of coal.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein either by surface or subterranean prospecting for mineral deposits, with a view to obtaining under the Regulations a mining location for the same but no mining location or mining claim shall be granted until the discovery of the vein, lode or deposit of mineral or metal within the limits of the location or claim.

QUARTZ MINING

A location for mining, except for iron on veins, lodes or ledges of quartz or other rock in place, shall not exceed forty acres in area. Its length shall not be more than three times its breadth and its surface boundary shall be four straight lines, the opposite sides of which shall be parallel, except where prior locations would prevent, in which case it may be of such a shape as may be approved of by the Superintendent of Mining.

Any person having discovered a mineral deposit may obtain a mining location therefor, in the manner set forth in the Regulations which provides for the character of the survey and the marks necessary to designate the location on the ground.

When the location has been marked conformably to the requirements of the Regulations, the claimant shall within sixty days thereafter, file with the local agent in the Dominion Land Office for the district in which the location is situated, a declaration or oath setting forth the circumstances of his discovery, and describing, as nearly as may be, the locality and dimensions of the claim marked out by him as aforesaid; and shall, along with such declaration, pay to the said agent an entry fee of FIVE DOLLARS. The agent's receipt for such fee will be the claimant's authority to enter into possession of the location applied for.

At any time before the expiration of FIVE years from the date of his obtaining the agent's receipt it shall be open to the claimant to purchase the location on filing with the local agent proof that he has expended not less than FIVE HUNDRED DOLLARS in actual mining operations on the same; but the claimant is required, before the expiration of each of the five years, to prove that he has performed not less than ONE HUNDRED DOLLARS' worth of labor during the year in the actual development of his claim, and at the same time obtain a renewal of his location receipt, for which he is required to pay a fee of FIVE DOLLARS.

The price to be paid for a mining location shall be at the rate of FIVE DOLLARS PER ACRE, cash, and the sum of FIFTY DOLLARS extra for the survey of the same.

No more than one mining location shall be granted to any individual claimant upon the same lode or vein.

IRON.

The Minister of the Interior may grant a location for the mining of iron, not exceeding 160 acres in area which shall be bounded by north and south and east and west lines astronomically, and its breadth shall equal its length. Provided that should any person making an application purporting to be for the purpose of

mining iron thus obtain, whether in good faith or fraudulently, possession of a valuable mineral deposit other than iron, his right in such deposit shall be restricted to the area prescribed by the Regulations for other minerals, and the rest of the location shall revert to the Crown for such disposition as the Minister may direct.

The Regulations also provide for the manner in which land may be acquired for milling purposes reduction works or other works incidental to mining operations.

Locations taken up prior to this date may, until the 1st of August, 1886, be re-marked and re-entered in conformity with the Regulations without payment of new fees in cases where no existing interests would thereby be prejudicially affected.

PLACER MINING.

The Regulations laid down in respect to quartz mining shall be applicable to placer mining as far as they relate to entries, entry fees, assignments, marking of localities, agents' receipts, and generally where they can be applied.

The nature and size of placer mining claims are provided for in the Regulations, including bar, dry, bench, creek or hill diggings, and the RIGHTS AND DUTIES OF MINERS are fully set forth.

The Regulations apply also to

BED-ROCK FLUMES, DRAINAGE OF MINES AND DITCHES.

The GENERAL PROVISIONS of the Regulations include the interpretation of expressions used therein; how disputes shall be heard and adjudicated upon; under what circumstances miners shall be entitled to absent themselves from their locations or diggings, etc., etc.

THE SCHEDULE OF MINING REGULATIONS

Contains the forms to be observed in the drawing up of all documents such as:— "Application and affidavit of discoverer of quartz mine." "Receipt for fee paid by applicant for mining location." "Receipt for fee on extension of time for purchase of a mining location." "Patent of a mining location." "Certificate of the assignment of a mining location." "Application for grant for placer mining and affidavit of applicant." "Grant for placer mining." "Certificate of the assignment of a placer mining claim." "Grant to a bed rock flume company." "Grant for drainage." "Grant of right to divert water and construct ditches."

Since the publication, in 1884, of the Mining Regulations to govern the disposal of Dominion Mineral Lands the same have been carefully and thoroughly revised with a view to ensure ample protection to the public interests, and at the same time to encourage the prospector and miner in order that the mineral resources may be made valuable by development.

COPIES OF THE REGULATIONS MAY BE OBTAINED UPON APPLICATION TO THE DEPARTMENT OF THE INTERIOR

A. M. BURGESS,

Deputy Minister of the Interior.

SEND FOR SAMPLES AND PRICES FOR

Asbestos Bags, Phosphate Bags, Ore Bags, &c.,

SPECIAL SIZES MADE TO ORDER.

DOUBLE SEWN.

DICK, RIDOUT & CO.,

PROPRIETORS TORONTO BAG WORKS,

Office and Warehouse: 11-13 Front St. East. Factory: 14, 16, 18, 20, 22 Bay St.

ESTABLISHED 1887.

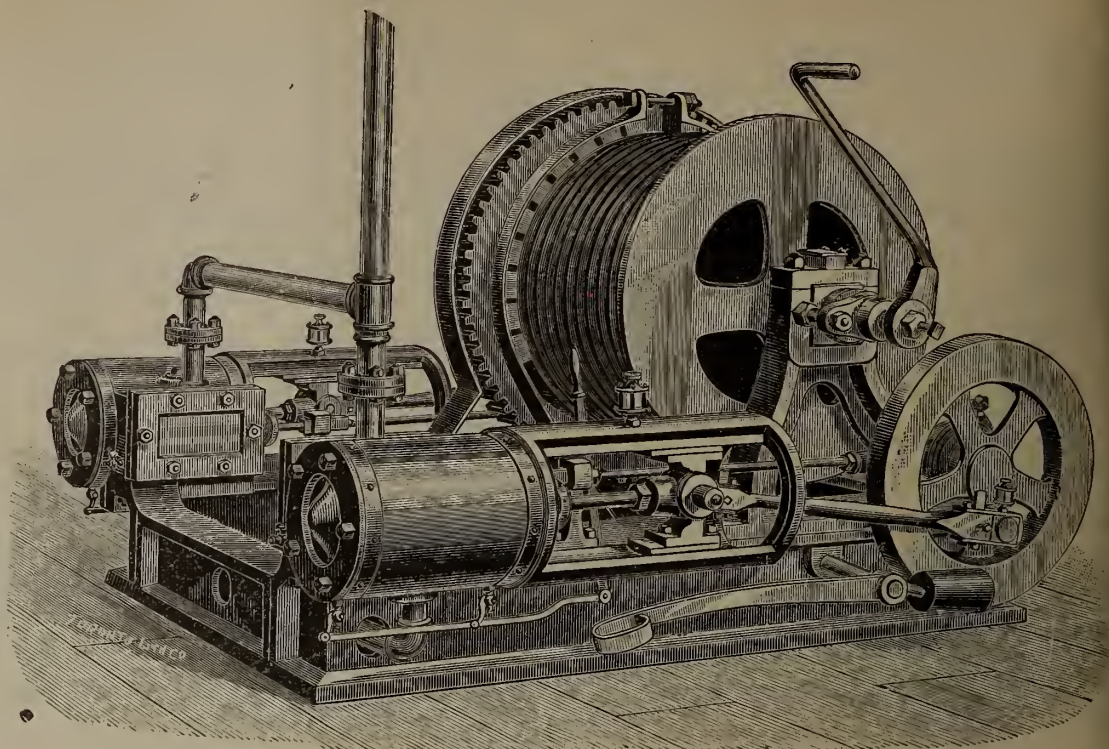
TORONTO.

JOHN DOTY ENGINE CO.

Toronto, Ont.

MANUFACTURERS OF

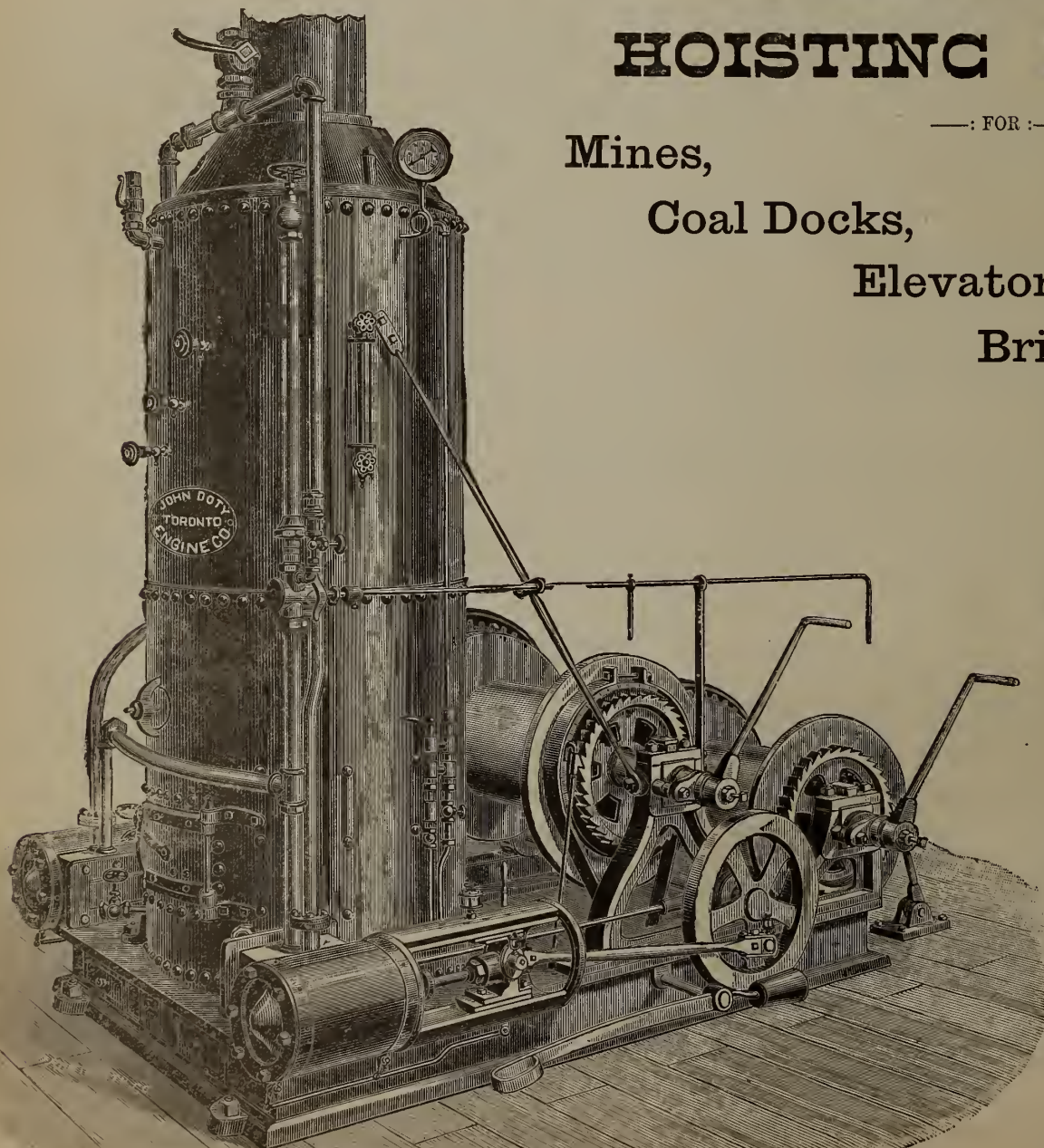
Mining & General
Machinery.



HOISTING ENGINES

—: FOR :—

Mines,
Coal Docks,
Elevators,
Bridge Builders,
Contractors, &c.



CORLISS ENGINES

Tug & Steam Yacht Engines,
Mill Engines.

Shafting & Mill
Gearing.

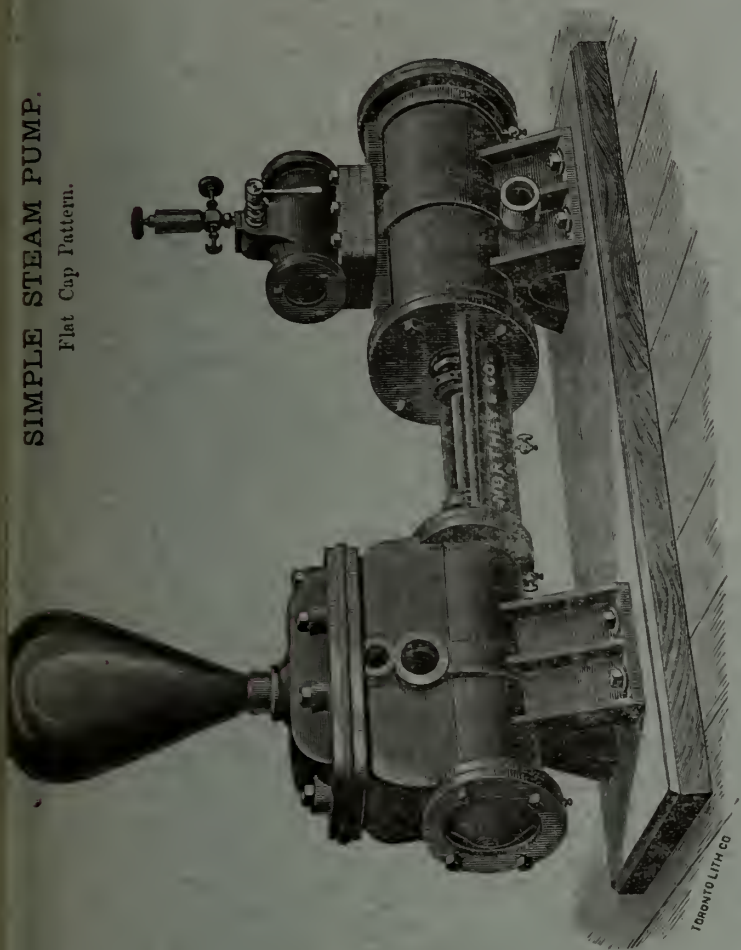
All Descriptions of Boiler
and Tank Work.

Send for Estimates and
Catalogues.

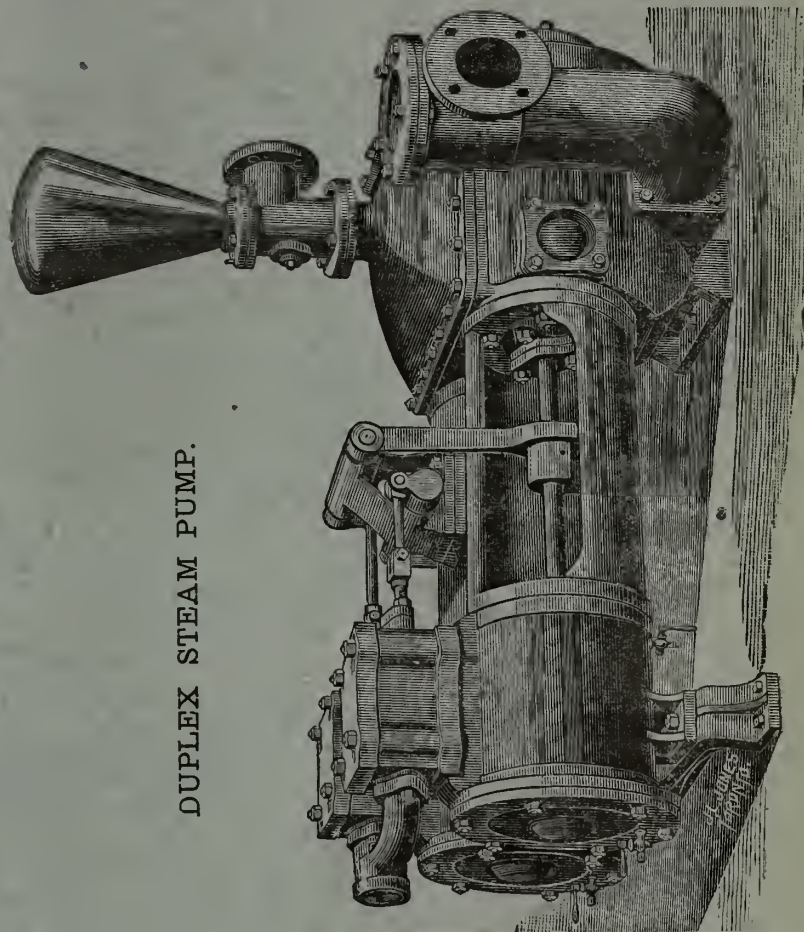
Northey & Co's Steam Pump Works, TORONTO, ONT.

SIMPLE STEAM PUMP.

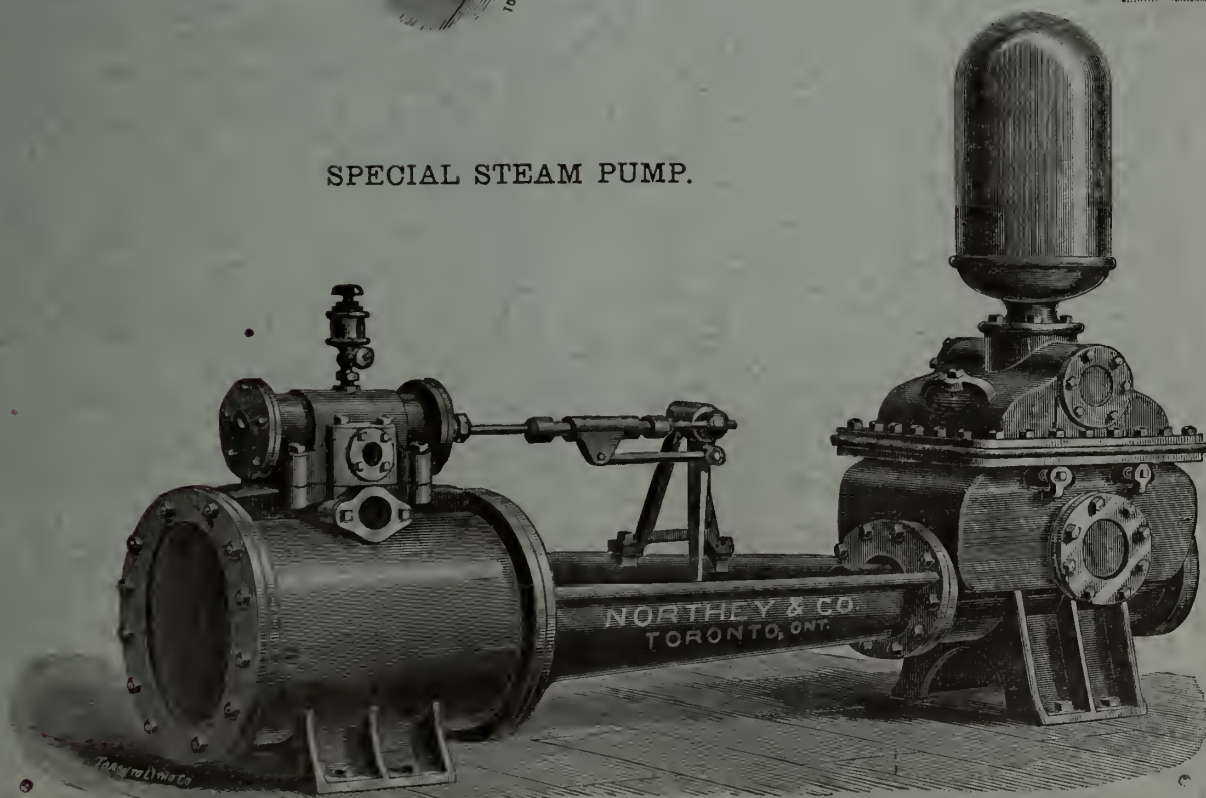
Flat Cap Pattern.



DUPLEX STEAM PUMP.

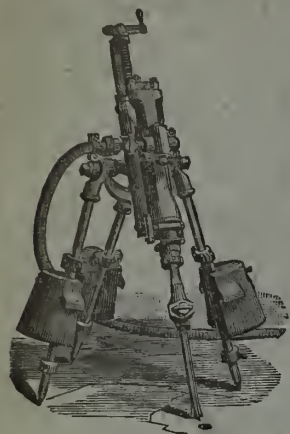


SPECIAL STEAM PUMP.



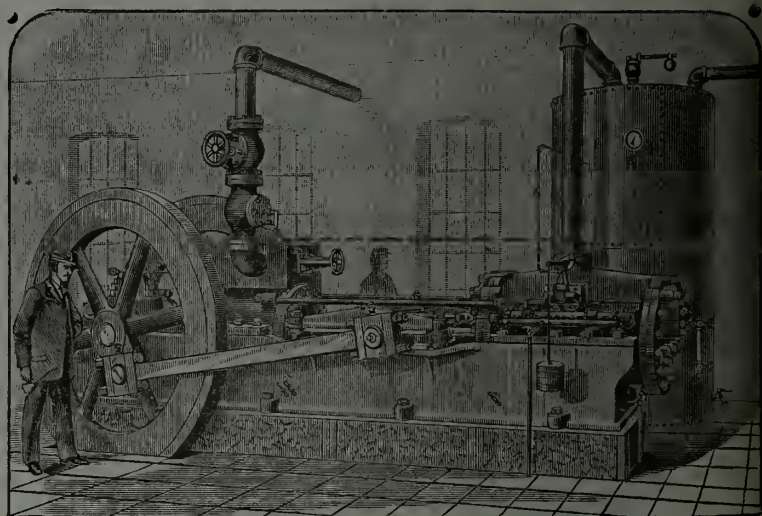
Steam Pumps of the best and latest designs for mining purposes, Boiler Feeding, Fire Protection, and General Water Supply, etc.

NORTHEY & CO.,
Mechanical  Hydraulic Engineers,    Toronto, Ont.
WORKS—COR. FRONT AND PARLIAMENT STS.

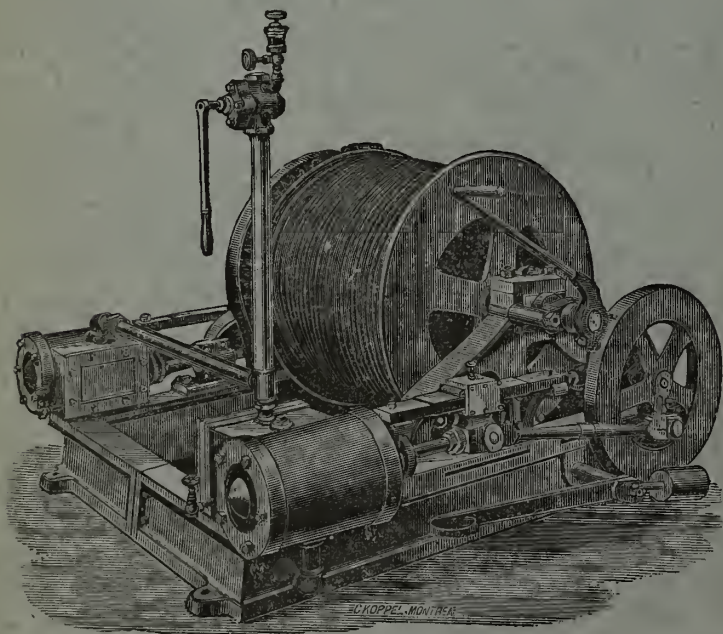


INGERSOLL
ROCK DRILL COMP'Y
OF CANADA
MANUFACTURERS OF

Rock Drills,
Air Compressors,
Steam & Horse Power Hoists,
BOILERS,
GENERAL MINING
Quarrying Machinery
Contractors' Plant.



— ALSO —



Drill Steel, Wire Rope,
Derrick Castings,
Steam & Air Hose & Couplings,
Iron Piping, Fittings,
ALL KINDS OF SUPPLIES
—FOR—
Miners & Contractors' Work.

For Estimates, Catalogues and information address

Ingersoll Rock Drill Co. of Canada

204 St. James St., or P.O. Box 1942, Montreal.

Established 1882

Vol. VIII.—No. 10.

FOR MINING PURPOSES

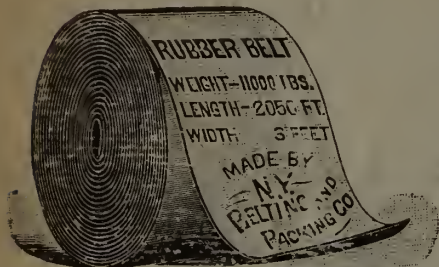
New York Belting & Packing Co.

15 PARK ROW, NEW YORK

JOHN H. CHEEVER, Treasurer.

J. D. CHEEVER, Dep'y Treasurer.

Oldest and largest Manufacturers in the United States of



RUBBER BELTING.

CIRCULAR WOVEN SEAMLESS, ANTI-SEPTIC RUBBER LINED

"CABLE" HOSE & TEST HOSE

For the use of Steam Engines, Force Pumps, Rolling Mills, Iron Works, Factories, etc. Woven in a superior manner to insure wear, compactness and durability.



"TEST HOSE."



Emery Vulcanite Wheel.

SOLID VULCANITE EMERY WHEELS

(Large Wheels made on iron centers)

Cuts Cooler and Freer than any other wheel in the market.

SALESROOMS:—Chicago, 151 Lake St.; Detroit, 16-24 Woodward Ave.; Boston, 52 Summer St.; Cleveland, 176 Superior St.

European Branch: Pickhuben, 5, Hamburg (Freihafenbeite), Germany.

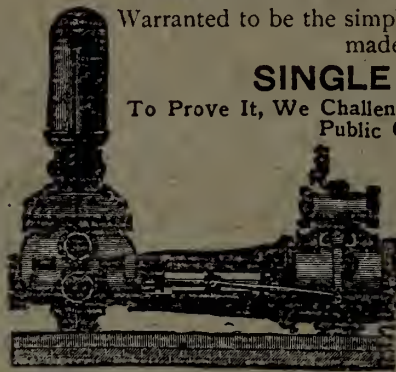
The M. T. DAVIDSON

IMPROVED MINING PUMP.

Warranted to be the simplest and most efficient Steam Pump made, whether it be

SINGLE OR DUPLEX.

To Prove It, We Challenge All Makers of Steam Pumps to a Public Competitive Test.



COMPOUND PUMPING ENGINES,

Obtaining a higher duty than any direct-acting pump made.

MANUFACTURED BY THE

Davidson Steam Pump COMPANY,

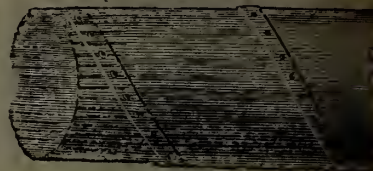
New York Office, - - - 77 Liberty Street.

ROOT'S

SPIRAL RIVETED PIPE

FOR

Hydraulic Mining,
Water Works
Ranch and Railroad
Water Supplies.



From 2 to 24 inches in diameter and 1 to 25 in length. Manufactured with fittings to suit, capable of withstanding any desired pressure.

ABENDROTH & ROOT MFG. CO.

28 Cliff Street, New York.

Chicago Branch, - - SMITH & KNAPP, 62 South Canal Street

LIDGERWOOD MANUF'G CO.

96 LIBERTY ST, NEW YORK,

34 & 36 WEST MONROE ST. CHICAGO, 197 TO 203 CONGRESS ST. BOSTON.

Largest Manufacturers in the United States of Hoisting Machinery of Every Description for Mines, Tunnel Work, Contractors, and General Hoisting Purposes.

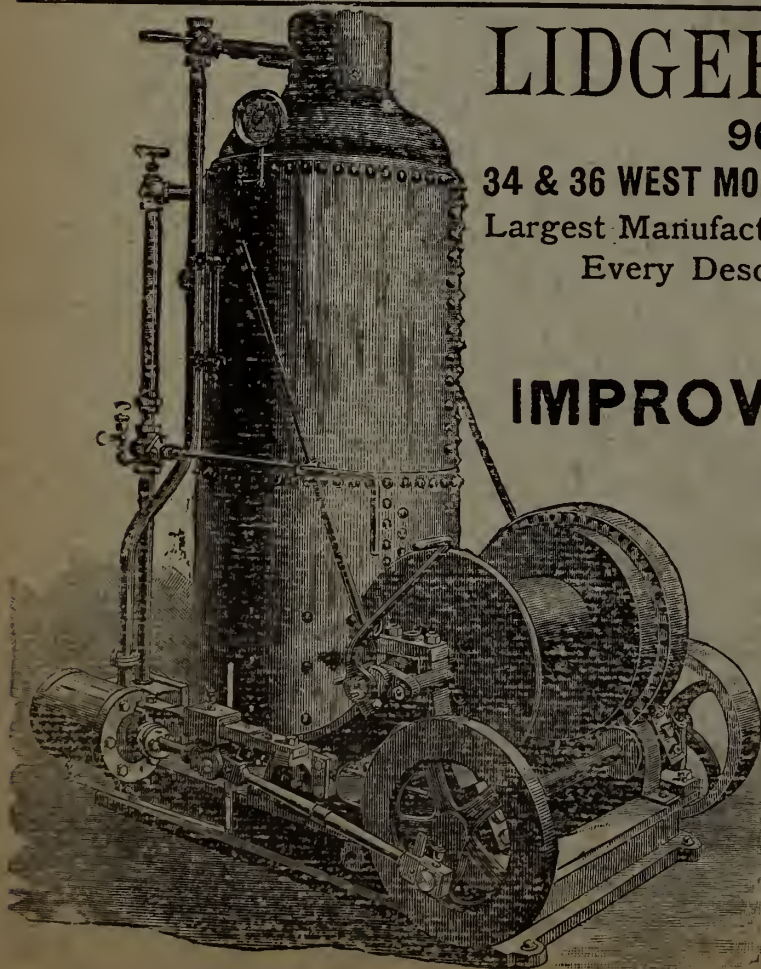
IMPROVED HOISTING ENGINES

FOR MINING PURPOSES A SPECIALTY.

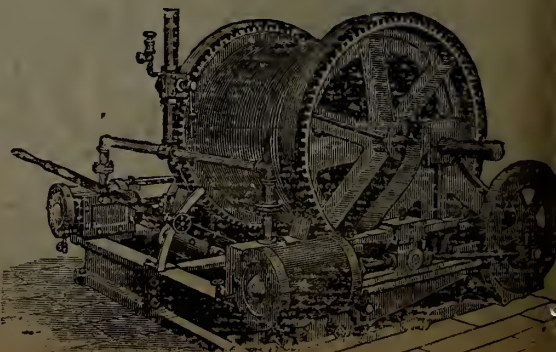
Over 5,000 Engines in Use!

300 Styles
and Sizes.

Send for
CATALOGUE.



FRICTION DRUM PORTABLE HOISTING ENGINE.



Double Cylinder Reversible Mine Engine.

F. G. BECKETT ENGINE CO.

HAMILTON, ONT.



Having had many years practical experience in the manufacture of

MINING MACHINERY

IS NOW PREPARED TO CONTRACT FOR

Stamp Mill Machinery,
Concentration Mills,
Revolving, Roasting and
Drying Furnaces.
Rock Breakers,
Cornish Rolls for crushing,
Amalgamating Pans and Settlers,
Concentrators and
Revolving Screens,
Smelting Furnaces, Retorts,

HOISTING ENGINES,

EITHER GEARED OR DIRECT ACTION.

Cornish Pumping Machinery,
Iron Ore Cars, Safety Cages, &c.,
Rock Drills and Air Compressors.

STEAM ENGINES AND BOILERS.

Marine Engines and Steam Yachts.

Francis D. Taylor
MINING ENGINEER,
BROCKVILLE, - ONTARIO

SPECIALTY. — The Mining of Iron Ores,
Coals, and the Manufacture of Iron and Steel.

Mr. T. has had for many years the manage-
ment of large mining enterprises in England
and the U. S. A.

CAMERON STEAM PUMP
SIMPLE, RELIABLE, COMPACT, DURABLE.
NO OUTSIDE VALVE GEAR.
THE A. S. CAMERON
STEAM PUMP WORKS.
ADAPTED FOR ALL PURPOSES.
FOOT OF EAST 23rd STREET, NEW YORK.



DOMINION ASSAY OFFICE AND MINING BUREAU.

Prospecting, Surveying and Examinations by Experts.
Mining properties purchased or floated on the European
markets; Capital found for developing same. Interest
in good mining property secured.

London Office: 21 Richmond St. E. } TORONTO
33 King St., Cheapside. 44 Victoria St.

**TAYLOR McVEITY,
Barrister, Solicitor, &c.,**

Supreme Court and Departmental Agent,
SCOTTISH ONTARIO CHAMBERS, OTTAWA.

WM. HAMILTON MERRITT, F.G.S.

Associate Royal School of Mines, &c.,
Mining Engineer and Metallurgist,
Will report on Mines and Mineral Properties.

ADDRESS:
15 TORONTO ST., TORONTO, ONT.

J. T. DONALD, M.A.,

Analytical Chemist and Assayer,
124 St. JAMES St. - MONTREAL
Analyses and Assays of every description. Manufactur-
ing processes practically tested. Laboratory instruction
in Chemistry, Assaying and Mineralogy. Terms on
application.

**THE DOMINION
Leather Board Co.**
MONTREAL,

—MANUFACTURERS OF—
Leather Board & Stiffeners
ALSO OF

**ASBESTOS MILL BOARD,
STEAM PACKING, and
FRICTION PULLEY BOARD.**

Samples and prices furnished upon ap-
plication.
Please mention this paper.



**ONTARIO
Mining Regulations.**

The following summary of the principal
provisions of the General Mining Act of
the Province of Ontario is published for
the information of those interested in
mining matters in the Algoma District,
and that part of the Nipissing District
north of the Mattawan River, Lake Nipis-
sing and French River.

Any person or persons may explore for
mines or minerals on any Crown Lands
surveyed or unsurveyed, not marked or
staked out or occupied.

The price of all lands sold as mining
locations or as lots in surveyed townships
is two dollars per acre cash, the pine timber
being reserved to the Crown. Patentees
or those claiming under them may cut and
use such trees as may be necessary for
building, fencing or fuel, or for any other
purpose essential to the working of mines.

Mining locations in unsurveyed territory
shall be rectangular in shape, and the
bearings of the outlines thereof shall be due
north and south, and due east and west
astronomically, and such locations shall be
one of the following dimensions, viz: eighty
chains in length by forty chains in width,
containing 320 acres, or forty chains square;
containing 160 acres, or forty chains in
length by twenty chains in width, con-
taining 80 acres.

All such locations must be surveyed by
a Provincial Land Surveyor, and be con-
nected with some known point or boundary
at the cost of the applicant, who must file
with application surveyor's plan, field notes
and description of location applied for.

In all patents for mining locations a
reservation of five per cent. of the acreage
is made for roads.

Lands patented under the Mining Act
are free from all royalties or duties in re-
spect to any ores or minerals thereon, and
no reservation or exception of any mineral
is made in the patents.

Lands situated south of the Mattawan
River, Lake Nipissing and French River
are sold under the Mining Act at one
dollar per acre cash.

Affidavits showing no adverse occupa-
tion, improvement or claim should ac-
company applications to purchase.

A. S. HARDY,
Commissioner.
Department of Crown Lands, Toronto.

**CANADA ATLANTIC
RAILWAY.**

THE SHORTEST PASSENGER ROUTE
BETWEEN

Ottawa and Montreal,
AND ALL POINTS EAST & SOUTH.

The only road in Canada running trains lighted
with electricity and heated by steam from the
engine. Luxurious Buffet Pullman Palace Cars
on all trains between Ottawa and Montreal. Only
line running through Sleeping Cars between

Ottawa, Boston and New York

And all New England and New York points.

Baggage checked to all points and passed by Cus-
toms in transit.

For Tickets, Time Table, etc., apply
to nearest agent, or to

S. EBBS, City Passenger Agent,
24 Sparks St., OTTAWA.

GEO. H. PHILLIPS, Gen. Agent,
VALLEYFIELD.

A. E. CAIRNS, General Agent,
136 St. James St., MONTREAL.

Or at 260 Washington St., Boston, and
317 Broadway, New York.

PERCY R. TODD,
General Passenger Agent

E. J. CHAMBERLAN,
General Manager,
General Offices, Ottawa.

TO MINERS AND OTHERS.

Bannerman & Powers,

VULCAN BOILER WORKS,
428 and 340 Wellington St., Ottawa.

MANUFACTURERS OF

IRON AND STEEL BOILERS

OF EVERY DESCRIPTION.

Tanks, Girders, Iron Roof-
ing, Bank Vaults, Smoke
Stacks

—AND ALL KINDS OF—

SHEET IRON WORK.

Repairs Neatly and Promptly Executed

FENWICK & SCLATER,

Manufacturers of Asbestos, Fire Hose, Files and Cotton
Waste, Miners of Asbestos and Soapstone,

ASBESTOS

Cotton, Leather and Rubber Belting,

42, 44 & 46 Foundling Street, Montreal.

H. R. IVES & CO.,

Hardware Manufacturers and Founders,
QUEEN ST., MONTREAL.

STOVES.	PORTABLE	MONTREAL	CASTINGS
TRADE MARK "Buffalo"	FORGES.	SMELTING CO'S	Of every description
IRON	BLACKSMITH'S	BABBIT	to order.
BEDSTEADS	DRILLS.	METAL.	SOIL PIPE.
FOR MINERS' USE.			

PORTABLE ENGINES AND SAW-MILLS

Of all capacities—from 3000 feet of lumber and up per day.

Saw-Mills.

Shingle-Mills.

Lath-Mills.

Chopping-Mills.

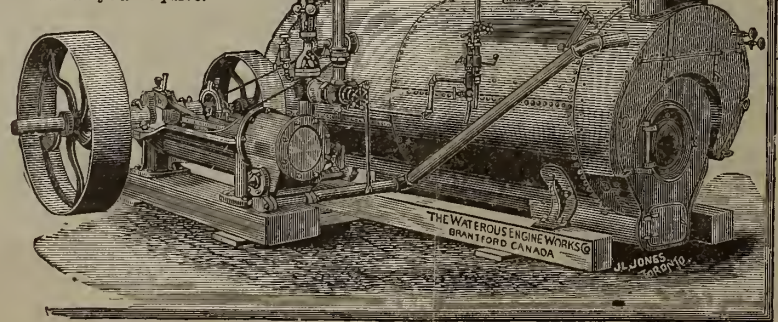
ENGINES

OF ALL SIZES.

BOILERS

of all capacities,
IRON OR STEEL,
ALL STYLES.

Send for Circulars, stating
what you require.



Waterous Engine Works Co. Brantford, Canada.
St. Paul, Minn., U.S.A.

JOHN E. HARDMAN, S.B.
MINING ENGINEER,
OLDHAM, NOVA SCOTIA.

Can be consulted on all matters pertaining to the profession.
 The development and management of Gold Properties a specialty.

WILSON & GREEN,
Commission Merchants,
PHOSPHATE SHIPPERS.
AGENTS HIGH ROCK MINE.
 30 St. François Xavier St., - MONTREAL.

EDMUND SPARGO,
 Consulting and Mining Engineer, 3 Cable Street, Liverpool.
 Owners of or Investors in Metalliferous Mines, Slate, Granite, and other Stone Quarries, Brick, Terra Cotta, Fire and other Clays and Mineral Estates in general, requiring reliable and sound advice either in the Purchase or Disposal thereof, should consult E.S., who has executed important professional Commissions in Germany, Austria, Hungary, France, Belgium, Spain, Portugal, Sweden, Norway, and in the various Mining Districts throughout Great Britain and Ireland. Telegraphic Address: "Spargo," Liverpool. Bankers, National Provincial Bank of England, Liverpool.

THOMAS HEYS,
 Analytical and Consulting Chemist and Assayer.
 References are kindly permitted by the following:
 Messrs. Gooderham & Worts, Toronto, Limited; Messrs. P. R. Lamb & Co.; John Livingston, Esq., Dominion Bolt Co.
 Assay and Analytical Laboratory,
 16 King St. West, opposite the Rossin House, } **TORONTO.**

J. LAINSON WILLS,
F. C. S., ETC.
 Late Manager Canadian Phosphate Co. (Lim.),
 Reports upon Mines and Mining properties.
 Advice given on Chemical and Metallurgical processes.
SPECIALTIES: PHOSPHATE AND GOLD.
 TELEGRAPHIC OR POSTAL ADDRESS:
WILLS, BUCKINGHAM, P.Q.

Irwin, Hopper & Co.
MINERS AND SHIPPERS OF MINERALS,
 30 St. François Xavier Street,
MONTREAL, CAN.
 Asbestos, crude and manufactured. Phosphate, Mica, Plumbago, Soapstone, &c.

JOHN D. FROSSARD, B.S., M.E.
MINING ENGINEER & GEOLOGIST,
 30 St. François Xavier St., - - - Montreal.
 Specialty—Phosphate Lands, &c.

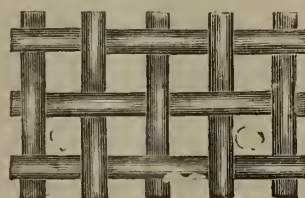
JAMES HOPE & CO.
BOOKSELLERS,
Stationers, Bookbinders and Printers,
OTTAWA.

SPEIGHT & VanNOSTRAND,
Dominion and Provincial Land Surveyors,
Draughtsmen, Valuers, &c.
 OFFICE: ROOM "J," FIRST FLOOR, TORONTO ARCADE,
 YONGE ST., TORONTO.
 Surveys, Plans, Descriptions of Properties, etc., promptly executed.
 Timber Limits and Mining Claims Located.

MILLAR & CO.
General Merchants & Shipping Agents
 ATLANTIC CHAMBERS,
 209 COMMISSIONER ST., - MONTREAL
 Cable address, "Hoyer, Montreal." P.O. Box 1095.
 AGENT FOR The Canadian Phosphate Co., Ltd., of London, Eng.,
 The Montreal Union Abattoir Co., of Montreal, Can.
 English Correspondents Messrs. Couper, Millar & Co., London, England.



For Mining Hoisting Derricks, etc.



Strong Wire Cloth and Screens
 For Mining, etc., manufactured by
The B. Greening Wire Co., Ltd.
 HAMILTON, ONT.

NATIONAL COLONIZATION
Lottery!
 UNDER THE PATRONAGE OF
THE REV. FATHER LABELLE.

Established in 1884 under the Act of Quebec, 31 Viet., Chap. 36, for the benefit of the Diocesan Societies of Colonization of the Province of Quebec.

CLASS D.
 DRAWINGS ON THIRD WEDNESDAY IN EVERY MONTH AT 2 P.M.

Prizes value \$50,000
 Capital Prize: 1 Real Estate worth \$5,000.

LIST OF PRIZES.

1 Real Estate worth	\$5,000	\$5,000
1 Real Estate worth	2,000	2,000
1 Real Estate worth	1,000	1,000
4 Real Estates	500	2,000
10 Real Estates	330	3,000
30 Furniture Sets	200	6,000
60 Furniture Sets	100	6,000
200 Gold Watches	50	10,000
1000 Silver Watches	10	10,000
1000 Toilet Sets	5	5,000

2307 Prizes worth..... \$50,000

Tickets, \$1.00!

Offers are made to all winners to pay their prizes cash, less a commission of 10 p. c. Winners' names not published unless specially authorized.

S. E. LEFEBVRE, Secretary.
 Office: 19 St. James St., Montreal, Can.

W. Blakemore, G.S., M.E., F. Member of I. & S.I. | A. Montgomery Evans, M.E. of Canada & U.S.

BLAKEMORE & EVANS,
MINING & CIVIL ENGINEERS
 Exchange Buildings, Cardiff, S.W.

LONDON OFFICE:
 Robert H. Jones, 82 Queen St., Cheapside, London, E.C.

Reports, Estimates, and Valuations of Iron and Steel Works
 Blast Furnaces, and all classes of Mining Properties.

CANADIAN BUSINESS PROMPTLY ATTENDED TO.

To Prevent Boiler Explosions
 And other accidents to steam boilers, and to secure economy in working, insure with
THE BOILER INSPECTION
AND INSURANCE COMPANY OF CANADA.

Sir Alex. Campbell, K.C.M.G., | John L. Blaikie, Esq.
 President. Vice-Pres.

HEAD OFFICE: - - - - - TORONTO
 G. C. ROBB, Chief Engineer.
 A. FRASER, Sec'y-Treas.

ORFORD COPPER CO.,
COPPER SMELTERS.

Works at Constable's Hook, N.J., opposite new Brighton, Staten Island. Copper Ore, Mattes, or Bullion purchased. Advances made on consignments for refining and sale. Specialty made of Silver-Bearing Ores and Mattes.

SELL
INGOT AND CAKE COPPER.
 President, **ROBERT M. THOMPSON,**
 Treasurer, **G. A. LAND.**
 Office, 37 to 39 Wall Street, New York.

Robin & Sadler,
 MANUFACTURERS OF
LEATHER BELTING.

TRY OUR
Waterproof Belting,
 Just the thing for Mining Machinery.

MONTREAL, TORONTO,
 2518, 2520, 2522 Notre Dame St. 129 Bay Street.

Diamonds, Jewelry, Watches & Silverware
AT ROSENTHAL'S
Goldsmith's Hall, 87 Sparks St.
OTTAWA.

T. D. LEDYARD,
DEALER IN MINERAL LANDS
 4 ONTARIO CHAMBERS, TORONTO.

Will buy undeveloped iron ore and other mineral properties.
 WANTED. — Deposits of Magnetic Iron Ore, Red Hematite, Brown Hematite, Galena, Iron and Copper Pyrites, Mica, Soapstone, Marble, Gypsum, Baryta. Samples can be sent by Sample Post for 1 cent for 4 oz. or up to 24 oz. in weight.
 Information regarding mines cheerfully given. Correspondence solicited. Crown Land Business attended to.

MACDONALD & CO., Limited,

—MANUFACTURERS AND DEALERS IN—

PUMPING MACHINERY, IRON PIPES, FITTINGS, &c., FOR MINERS' USE.

Call or Write us for Prices.

HALIFAX, N.S.

DODGE PATENT

Wood Separable Split Pulleys

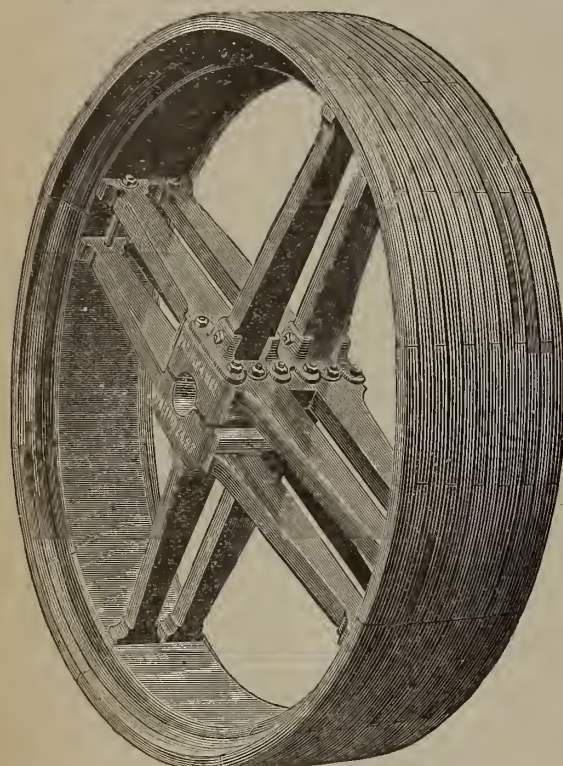
Best Belt Surface, Lightest, Strongest, Best Balanced and Most Convenient Pulley in the World.

WITH OUR PATENT BUSHING SYSTEM

In Comparing Prices of Pulleys please note carefully the following:

1. Our list is lower than most others.
2. Every Pulley is a Split Pulley.
3. Every Pulley is guaranteed to transmit from 25 to 60 per cent. more power than an iron one with same tension of belt.
4. Our Pulleys are 70 per cent. lighter than iron pulleys.
5. The fastening does not mar the shaft.
6. They are perfect in Balance.
7. They can be used on many different sizes of shafting.
8. They are the most thoroughly made wooden pulleys in the world.
9. And the handsomest pulley on the shaft.
10. No chances to take. Every pulley as represented or no sale.

Order a Sample Pulley, after which you will have no other.



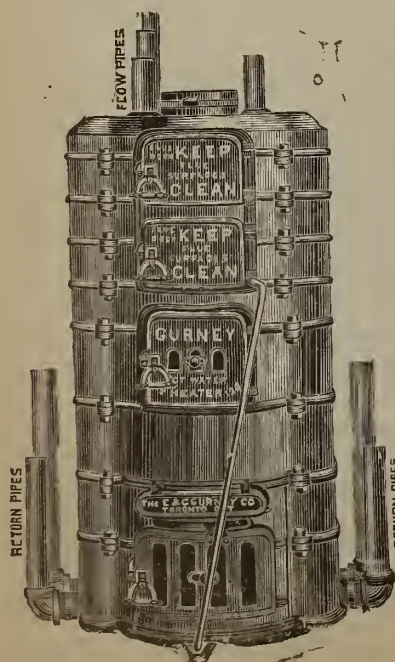
EVERY PULLEY IS A SPLIT PULLEY
Made in any size from 9 inches to 16 ft. diameter with original bores of 3 and 3½ inches, bushings to be used for intermediate sizes; larger ones bored to order.

**WE ALSO MANUFACTURE
WOODEN GROOVED PULLEYS FOR THE TRANSMISSION OF POWER
BY MANILLA ROPE,**

Under the Dodge Patent System from 5 to 500 h. p. State power to be transmitted, speed of shafts, relative position of shafts, distance between shafts, and we can furnish a clear estimate.

EVERY PULLEY WILL FIT.
22 or more sizes of Shafting.
200 of our Pulleys and an assortment of bushings represent as many as 4,000 iron pulleys, a great advantage to dealers carrying stock.

Apply for particulars to **THE DODGE WOOD SPLIT PULLEY CO., TORONTO.**



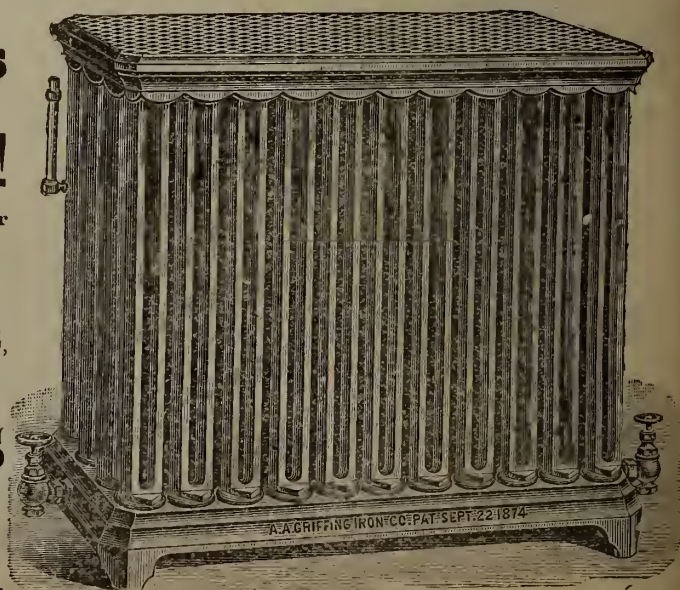
USE GURNEY'S IMPROVED CELEBRATED Hot Water Heaters!

Guaranteed more Economical than any other Heater now made, and containing every known Improvement in Hot Water Heating.

STEAM FITTINGS, CAST IRON PIPE,
REGISTER, GRATES, ETC.

HOT AIR FURNACES
FOR COAL OR WOOD.

**E. & C. GURNEY & CO.,
MONTREAL.**



Bundy Radiators for Quick Circulation and Economy of Space.

CHEMICAL APPARATUS! OF EVERY DESCRIPTION.



Glass, Porcelain, Stoneware, Platinum Crucibles of every sort, Analytical Scales and Weights, Fine Chemicals and Reagents, including Volumetric Solutions. Every requisite for Analysis or Experiment. For Sale by

LYMAN, SONS & CO.,
384 St. Paul St., Montreal.

Illustrated Catalogue mailed on receipt of 10c. or Business Card.

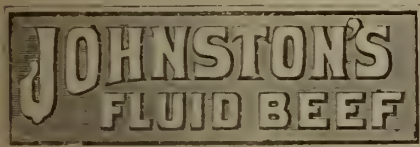
Boiler For Sale.

A N EIGHTY H.P. TUBULAR STEEL BOILER made by W. C. White, Montreal, 15 ft. x 5 ft. 4 in. eighty 3 1/2 in. tubes; smoke stack 45 ft. long; guylards and guys. Very little used. Equal to new. Price on cars, \$600. Address

P. O. Box 6,
MONTREAL.

A WANT.

A Food that contains the greatest amount of nourishment in the smallest possible bulk, that can be relished, easily digested, and that will QUICKLY NOURISH AND STRENGTHEN. This want is fully supplied by



It contains more concentrated nourishment than any other preparation. The NUTRITIOUS ELEMENTS being in a partially digested form, it can be retained and thoroughly assimilated by the weakest stomach, and it cannot fail to permanently benefit.

Victor Electric Fuses.

Superior to all others for Exploding any make of Dynamite, High Explosives, or Gelatine Powder. Each Fuse is tested and warranted extra strong and waterproof. Low grades of Dynamite Powder will do ten per cent. more execution if detonated with Victor Electric Fuses.

VICTOR BLASTING MACHINES.

Latest improvements, made in three sizes, easy to operate, strong and durable. No expensive repairs, low in price, will fire any make of Electric Fuses.

MANUFACTURED ONLY BY

JAMES MACBETH & CO.,

128 Maiden Lane, N.Y., U.S.A.

Send for Catalogue.

ASBESTOS.

THEO. HAMEL,

44 Mountain Hill, Quebec,

SOLE ASBESTOS MANUFACTURER in CANADA

Write for prices and catalogue. Use Asbestos and save your money. Applied on boilers and Steam pipes it will prevent them from rusting and will economize 33% on fuel.

Gold Mining Supplies.

The principal depot in Nova Scotia, carrying the most complete assortment of first class goods, is

H. H. FULLER & CO'S,
41 to 45 Upper Water St., Halifax, N.S.

Our line comprises Explosives, Fusc, American and English Mill and Hammer Steel, Bar and Bolt Iron, Steel Wire Hoisting Rope, Hemp and Manilla Rope, Rubber and Leather Belting, Miners' Candles, Oils and Lamps, Miners' Tools, Machinists' Tools, Blacksmiths' Tools, and every requisite for the gold miner.

H. H. FULLER & CO.,
Halifax, N.S.

A Great Blast.—Recently at a quarry at Bethlehem, N.Y., 50 holes were bored to a depth of 30 feet, and these were charged with about 40 lbs. of dynamite each. The holes extended along the ledge for a distance of 350 feet. The amount of rock displaced by the blast is estimated at from 20,000 to 25,000 tons. Of course, in comparison with the Hell Gate blast in 1876 and the Flood Rock in 1885, this blast is insignificant. At the Flood Rock explosion, 240,000 pounds of rack-a-rock and 40,000 pounds of dynamite were fired, by far the greatest quantity of explosive ever used in one blast, and about 400,000 tons of rock were broken up.

MAP

—OF THE—

PHOSPHATE REGION

—OF—

OTTAWA COUNTY, QUE.

This, the only Map of the Phosphate Region now extant, embraces the Townships of

BUCKINGHAM, HULL, PORTLAND

(East and West), WAKEFIELD

TEMPLETON, DERRY, THE

GORE OF TEMPLEYON,

VILLENEUVE, &c.

The location of all mines now or lately in active operation are prominently delineated.

As only a few copies of this excellent Map remain unsold, orders should be sent in without delay.

PRICE, TWO DOLLARS.

On sale only at the offices of

THE CANADIAN MINING REVIEW,
OTTAWA.

ALEX. RANKIN,

20 Toronto Street, Toronto Ont.

Agent for sale of Mines and Mineral Lands.

CORRESPONDENCE SOLICITED.

Agents in England and New York.

HARRIS & CAMPBELL

Latest Designs in Drawingroom, Diningroom and Bedroom

FURNITURE

With improved Steam Machinery our facilities for manufacturing Cabinet Goods are complete. Our upholstery Department is well stocked with latest imported patterns.

Corner **QUEEN & O'CONNOR Sts**
OTTAWA.

THE DOMINION

SAFETY BOILER CO.

MANUFACTURERS OF

The "Field-Stirling" Patent High Pressure Boiler,

The Safest and Cheapest Steam-Generator now in Use.

This Boiler is unusually durable, being made of the best steel and wrought iron exclusively. No cast-iron is employed. It is simple in construction, has a rapid, well-defined circulation, and a large cool mud-drum, where all impurities are collected to be blown off. All parts of the Boiler are readily accessible for the closest inspection. It has great excess of strength and is not liable to be strained by unequal expansion. The water space is divided into sections so arranged that NO EXPLOSION IS POSSIBLE.

Some of Our Leading Customers:

The J. A. Converse Mfg. Co. (A. W. Morris & Bro.), Montreal; The Canada Sugar Refining Co., Montreal; The Pillow and Hersey Mfg., Montreal; The Berthier Beet Root Sugar Co., Berthier, Que.; The Imperial Insurance Co., Montreal; The Massey Manufacturing Co., Toronto; The Acadia Coal Co. (L'd.), Steglarton, N.S.; Canada Paper Co., Windsor Mills, Que.; Royal Electric Co. (Central Station), Montreal; Dodge Wood Split Pulley Co., Toronto, and a repeat order from A. W. Morris & Bro., after five months' experience; Ingersoll Rock Drill Co. of Canada.

We guarantee Dry Steam and Great Economy of Fuel. Correspondence Solicited.

J. FRASER TORRANCE, M.E.,

P.O. Box 1707, Montreal.

Manager

EDMUND C. SHOREY, M.A.,

Analytical Chemist,

FOOT OF PRINCESS STREET } - - KINGSTON.

MINERALS OF ALL KINDS assayed at reasonable rates
Analyses of Milk, Water, &c.

PHOSPHATES A SPECIALTY.

D. McEWEN & SON,

Machine, Engine & Boiler Works

(Established January, 1868)

Compound and Yacht Engines a Specialty.
Estimates for Steamboats complete.

MINING REPAIRS CONSTANTLY ON HAND.

WORKS AND OFFICE:

54 to 60 Queen Street, Kingston, Ont.

If you want

BAGS

FOR PACKING

ASBESTOS, PHOSPHATES, ORES, &c.,

Send to us for Samples and Prices.

Every quality and size in stock.

Specially strong sewing for heavy materials.

Lowest prices compatible with good work.

We now supply most of the Mining Companies, and those who have not bought from us would find it to their advantage to do so.

THE CANADA JUTE COMPANY (LTD.)

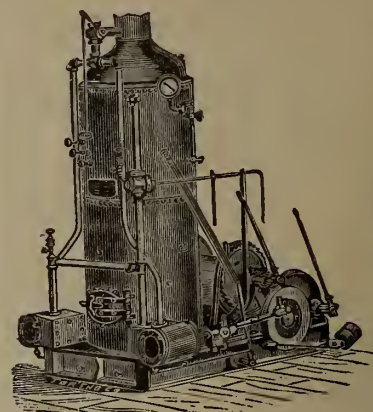
17, 19 & 21 ST. MARTIN STREET,

Established 1882.

MONTREAL.

M. BEATTY & SONS,

WELLAND, ONT.



HOISTING
ENGINES

ENGINES

FOR

Mines

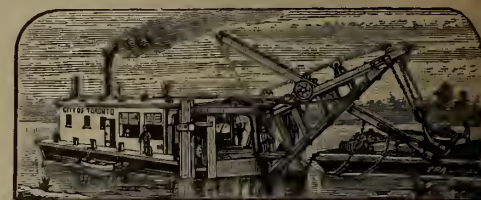
AND

Inclines

Horse-Power Hoisters,

Stone Derrick Irons,

Centrifugal Pumps



DREDGES,

DERRICKS,

STEAM SHOVELS,

And other Contractors' Plant.

AMALGAMATING MACHINERY.

Stamp Mills for Wet or Dry Crushing. Huntington Centrifugal Quartz Mill. Drying Cylinders. Amalgamating Pans, Settlers, Agitators and Concentrators. Retorts, Bullion and Ingot Moulds, Conveyors, Elevators, Bruckners and Howell's Improved White's Roasting Furnaces, Etc.

CONCENTRATING MACHINERY.

Blake, Dodge and Comet Crushers, Cornish Crushing and Finishing Rolls, Hartz Plunger and Collom Jigs. Frue Vanner & Embrey Concentrators, Evans', Calumet, Collom's and Rittenger's Slime Tables. Trommels, Wire Cloth and Punched Plates. Ore Sample Grinders and Heberle Mills.

FRASER & CHALMERS, MINING * MACHINERY.

Improved Corliss and Slide-Valve Steam Engines,
Boilers--Horizontal, Vertical and Sectional,
IMPROVED STEAM STAMPS.

Hoisting Engines, Safety Cages,
Safety Hooks,
Ore Cars, Water and Ore Buckets,
Air Compressors, Rock Drills, Etc.
General Mill and Mining
Supplies, Etc.



Pumping Engines and Cornish
Pumping Machinery,
Improved Water Jacket
Blast Furnaces for Calena and
Copper Ores.
Slag Cars and Pots,
Roots & Baker Pressure Blowers,
Suspended Tramways.

Sectional Machinery for Mule-Back Transportation.

General Offices and Works: FULTON & UNION STS., CHICAGO, ILL.

BRANCH OFFICES: NEW YORK, Room 43, No. 2 Wall St. DENVER, COLO., 1316 Eighteenth St. SALT LAKE CITY, UTAH, 7 West Second South St. LONDON, ENGLAND, 23 Bucklersbury, E. C. CHIHUAHUA CITY, MEXICO, No. 11 Calle de Juarez. LIMA, PERU, South America. JOHANNESBURG, TRANSVAAL, South Africa.

Sole Western Agents for TYLER WIRE WORKS Double Crimped Mining Cloths.

The Canadian Mining Review

CONDUCTED BY . . . R. T. A. BELL

OFFICES:

UNION CHAMBERS, 14 Metcalfe St.
OTTAWA.

Vol. VIII. SEPTEMBER, 1889. No. 9.

To Our Readers.

Owing to the press upon our space incidental to the recent Meeting in Canada of the American Institute of Mining Engineers, we have been compelled to hold over our usual notes from the mines, and other interesting matter.

Obituary.

We regret very much to have to record this month the sudden demise of Professor David Honeyman, Curator of the Nova Scotia Museum of Natural Science. The deceased gentleman will long be remembered as one of the greatest authorities on the Geology of eastern Nova Scotia and Cape Breton.

The sudden death of T. H. Hulbert, M.E., chief owner and manager of the Mink Mountain Mine, near Port Arthur, from an accidental overdose of morphia, takes from us one of the ablest pioneer explorers and mining engineers this district has ever seen.

The Visit of the American Institute of Mining Engineers.

The recent visit paid by the American Institute of Mining Engineers, and the holding of their autumn Session at the Capital was a feature of international courtesy amongst members of the mining profession which would well bear repetition, and the fruits of which cannot but be productive of immense advantage to Canada. When it was definitely ascertained early in the year that this visit was decided upon, a large citizens' committee was formed to take the necessary steps to carry out all requirements. This, however, soon resolved itself, as all such gatherings do, into a few energetic workers, to whom it became a "labour of love" to think out and arrange for the comfort of the coming guests, and to select what excursions would best enable them to see the mineral treasures of our country, and at the same time afford a pleasant trip in each of the provinces of Ontario and Quebec. Well did this committee carry out its work, and the voice of the visitors was unanimous in praise of everything done for them. The proceedings of the Session and the various excursions are described elsewhere. The number of our visitors was not so large as had been expected, but what was lacking in quantity was made up in quality, for those who came were all leading representative men at the head of their profession, and experts in every respect.

It is a matter of regret that only one representative of the iron trade, Mr. John Birkenbine, was in attendance. The slimness in the attendance of

this most important branch of the profession is however accounted for from the unusual activity now prevailing in the iron industry, and the largely increased number of blast furnaces now at work across the line; to the fact of the Paris Exhibition having induced a number of this class of the community to pay it a visit, while the lateness of the season and the inclemency of the weather prevented many more from attending who otherwise would have been present.

To this latter fact also is mainly due the abandonment of the proposed trip to the silver and iron districts of Port Arthur. The enterprising population of that rising town were disappointed, and rightly too, at the abandonment of that trip, for they had made the most elaborate arrangements for their expected visitors. To close this brief reference without mentioning the deep interest shown in everything by the ladies who accompanied a number of our American guests, would make it very incomplete, and their presence on the excursions, where despite the very bad weather prevailing they were the life and soul of the party, added materially to the success of the whole proceedings. We look forward with pleasure to another visit to Canada at some future day, of this distinguished body, the American Institute of Mining Engineers, and hope that what the visiting members have lately seen in their tour will tend to increase in every way the relationship which nature designed should always exist between the two nations of the North American continent.

Deep Gold Mining in Nova Scotia.

In the gold districts of Nova Scotia an auriferous quartz vein usually presents one or more irregular patches of ore richer than the quartz bounding it on the longitudinal extension of the lode. These rich "pay streaks or chimneys" vary in length and depth up to five hundred feet. They dip at various angles to the horizon, and do not materially differ from those found in other parts of the world. It is not necessary to allude here to the many ingenious theories which have been advanced to account for this concentration of gold, etc., at certain points in the vein, but it may safely be said that no law is known governing their formation in Nova Scotia, and the remark of an old miner best fits, that there would be no fun in gold mining without it.

As already remarked the shape of these pay-streaks is irregular, and they vary equally in their extent. Some outcrops of paystreaks have been followed but a short distance, while others have repaid the miner's toil to a depth of 600 feet, and others again have been struck accidentally in underground workings. Hitherto in Nova Scotia the life of a mine has usually ended when the paystreak gave out, the exceptions being the operations in slate belts, and in comparatively low grade veins, and it has become

a generally accepted axiom that there is no use in pushing explorations in barren quartz. A paper read at the last meeting of the Royal Society of Canada certainly gives reasons for expecting that the veins would thin out in depth, but it is also pointed out that the depth at which this thinning out may be met is far beyond the deepest mining yet reached here or in other countries.

In view of this abandonment of mining when the pay quartz in sight is extracted, the question of the enrichment of the veins at lower depths is of great importance to the Province as well as to the miner. Without the expression of an opinion as to the probability of the occurrence of rich paystreaks at greater depths, or the renewal of a paystreak, after an interval of barren quartz, on the line of prolongation of its greater axis, it may be remarked that, as the fact of lateral enrichment of a vein has been proved by the occurrence in it of more than one paystreak, there appears to be, in comparison with the limited extent of mining operations, no reason why similar enrichments should not be found in depth.

As yet no mining company in the Province has tried to prove this point, although its importance has been recognized by those who have been fortified by foreign experience, and the desire of securing the fullest possible return for the expense of purchase and equipment of their mines. Applications have been made to the Provincial Government to undertake the task, or to subsidise companies who might offer to carry out the test. The opinion of the applicants being that either a new shaft should be sunk in any district specially selected, or that in any district a shaft which had intersected a pay streak should be continued to a depth of from 800 to 1,000 feet.

The most apparent objection to the Government trying the experiment, either directly or indirectly, is that a failure in any district would be merely a negative proof, and would be quoted against the value of the deposits, and the consideration of experience would presumably not allow of this most admirable method of investigation being tried very often. In Australia large sums are annually expended by the Government in prospecting with diamond drills for the purpose of exploring for new gold fields. There, the conditions under which the gold occurs, as comparatively level deposits overlaid by immense masses of trap, etc., are favorable to this method of exploration. In Nova Scotia the alternating beds of slate and quartzite are inclined at high angles, the veins are numerous, and the work of boring would be extremely expensive, while the comparative narrowness of the veins would make a "test core" of a free gold vein, even if the drill penetrated a pay streak, of uncertain value.

A writer in a local paper some time ago suggested another way of approaching this matter, which is free from some of the objections

alluded to. The idea was that the Government should offer a bonus to the company which should first show practically the existence of gold in remunerative amounts at a depth exceeding, say nine hundred feet. If the chance of a good bonus was displayed, a company working quartz at a depth of 300 or 400 feet at a fair profit, could try the experiment without incurring a very heavy expenditure. If unsuccessful, the bonus would remain for another test, made perhaps in a different district, and under conditions possibly more favourable.



The Meeting of the American Institute of Mining Engineers at Ottawa.

The fifty-fifth meeting of the Institute was held at Ottawa during the week commencing Tuesday, 1st October. When the very large membership of the Institute is considered, numbering, as it does, close upon 2,500 members, a comparatively small attendance was registered when the first session was called to order. Many reasons may be given to account for this. As stated in our last issue, a large number of members had just returned from a European trip extending over several months, another considerable number were present at the Denver meeting in June, while others were present at the Toronto meeting of the American Association for the Advancement of Science and these, of course, found it difficult to get away again this year. Again, there has been a very decided revival of business in the United States, particularly in the iron trade, where blast furnaces are being blown-in, contracts are under negotiation, and engagements are more important and imperative than usual. The attendance of Canadian members was also not so large as expected. The following members of the Institute, and invited guests, were present during the meeting:—Dr. Chas. A. Asburner, Asst. State Geologist of Pennsylvania, and Mrs. Asburner, Pittsburg; S. E. Bretherton, Leadville, Colo.; Martin L. Griffin, Holyoke, Mass.; Dr. H. T. Bovey, Montreal; Capt. R. C. Adams, Managing Director Anglo-American Phosphate Co., Montreal; J. H. Bramwell, coal operator, Bramwell, Va.; C. S. Bedell, U. S. Assay Office, New York; B. T. A. Bell, editor CANADIAN MINING REVIEW, Ottawa; Dr. Robt. Bell, Geological Survey of Canada, Ottawa; John Birkinbine, M.E., editor *Journal of Chemical Workers*, Philadelphia; W. B. Cogswell, General Manager of the Solvay Process, and Miss Mabel Cogswell, Syracuse, N.Y.; J. B. Church, Mrs. Church, Miss DeLaney and Miss Bright, Geneva, N.Y.; W. S. DeCamp and Mrs. DeCamp, Lyons Falls, N.Y.; C. A. DeCamp and the Misses S. M. and M. A. DeCamp, Boonton, N.Y.; Prof. Thos. Egleston, School of Mines, New York; Dr. R. W. Ells, Geological Survey of Canada, Ottawa; T. R. Gne, President Acadia Powder Co., Halifax, N.S.; W. H. Hulick, Easton, Pa.; John E. Hardman, S. B. Oldham, N.S.; L. Holbrook, New York;

Wm. H. Hale, *Engineering and Mining Journal*, New York; Dr. B. J. Harrington, McGill University, Montreal; W. H. Hutcheson, Anglo-Continental Guano Works, London, Eng.; C. H. Joliet, Roselle, N.J.; Jas. E. Jopling, Marquette, Mich.; J. T. B. Ives, Toronto; E. D. Ingall, M.E., Geological Survey, Ottawa; C. Kirchoff, Jr., editor *Iron Age*, New York; J. S. Lane, M.E., M. C. Bullock Mfg. Co., Mrs. Lane and W. A. Lane, Chicago, Ill.; N. M. Langdon, Port Henry, N.Y.; A. P. Lowe, Geological Survey, Ottawa; Thos Macfarlane, F.R.S.C., Ottawa; F. H. Macdowall, Consulting Engineer, Tilley Foster Mine, New York; Major R. G. Leckie, Sherbrooke, Que.; A. N. Newell, Bradford, Pa.; J. Obalski, Mining Engineer to the Province of Quebec, Quebec; J. C. Platt, Waterford, N.Y.; F. Prince, General Manager Slate Mining Co., Slatington, Pa.; Dr. E. D. Peters, Jr., General Manager Canadian Copper Co., Sudbury; John C. F. Randolph, New York; Addison C. Rand, President Rand Drill Co., and Miss Josephine Rand, New York; Dr. R. W. Raymond, Montana Smelting Co. and Secretary to the Institute, Miss Elizabeth Raymond and Miss Atherton, New York; Theo. D. Rand, Philadelphia, Pa.; T. R. Redpath, Montreal; Prof. John C. Smock, Albany, N.Y.; Prof. S. Sharples, Boston, Mass.; T. Trimble, Managing Director Templeton and Blanche River Phos. Co., Montreal; J. Lainson-Wills, F.C.S., Buckingham; P. Würgbürger, M.E., Antwerp, Belgium, etc., etc.

Opening Session.

The opening session was held on Tuesday evening, 1st October, in the large room, House of Commons, usually occupied by the meetings of the Royal Society of Canada, and known as the Railway Committee Room. When proceedings commenced the hall was completely filled. Beside the members of the Institute, there were present a goodly sprinkling of local mining men and a large number of ladies.

Mr. B. T. A. Bell, Secretary of the Citizens' Committee, read letters regretting inability to be present from Sir Hector Langevin, Minister of Public Works; Hon. A. S. Hardy, Commissioner of Crown Lands, Toronto; Hon. G. Duhamel, Commissioner of Crown Lands, Quebec; and from His Worship the Mayor of Ottawa.

SHERIFF SWEETLAND—Mr. President, Ladies and Gentlemen of the Am. Inst. of M. E.: As Chairman of the Local Committee, it is my duty, and a very pleasing duty it is, to extend to you a hearty welcome to Ottawa. In doing this I speak on behalf of the citizens who appointed the gentlemen who act with me as the Local Reception Committee. We feel honored that you have made Ottawa your choice for this year's Autumn Meeting. I believe this is the third time that the Institute has met in Canada, and I trust that this may be reckoned hereafter as one of the most successful meetings ever held by the Institute. So far as the Committee and the people here are concerned we will endeavor to make it so. We have been assisted very materially by the liberal Grants from the Federal and Provincial Governments, so that the welcome is not confined to the city itself. The co-operation of the different governments is the best evidence that the country appreciates the position which you occupy as practical scientific men. I think I may use the word practical in connection with your Institute, because you are all workers as I understand it. You are all anxious to take from the bowels of the earth those economic minerals which are necessary to promote a higher civilization. We all work for that common purpose. It makes no difference whether we are on one side of the line or the other. I am glad to see that yours is an American Institute, that it covers the whole of this great continent. Although you meet sometimes in the south, sometimes in the extreme west, and at other times in the east, you occasionally pay a flying visit as you do now to the north. In Canada we have a very great deal to show you that I am satisfied will be of the greatest interest to yourselves, as well as, I hope, of interest and benefit to ourselves. The mineral resources of this vast country have as yet been scarcely touched. What little mining has been done has been but a tickling of the surface, but we have endeavored to show you by the series of excursions arranged for the latter part of this week that this northern portion of the American continent possesses vast and almost unlimited mineral wealth. We are going to take you over more

than 1,200 or 1,500 miles of our country and that is only a small portion of it, as you know, but it is as much as we can possibly show you on a flying visit such as this. I do not intend to, nor should I occupy your time this evening. I am merely supposed to extend to you a hearty and cordial welcome. I have on my right no less a personage than the Rt. Hon. Sir John A. Macdonald, a gentleman whom we in Canada look upon as being without a peer, and I think we are safe in saying so. (Cheers.) We have also a member of the Quebec Government, the Hon. Mr. Ross, Minister of Public Works, who comes from a Province which is deeply interested in the development of her mines. I will now introduce to you the Rt. Hon. Sir John A. Macdonald.

SIR JOHN A. MACDONALD—Gentlemen of the American Institute of Mining Engineers, I shall join as a citizen of Ottawa with my good friends in wishing you a hearty welcome. We are very proud indeed to know that your Institute has already honored Canada so far as to have visited it on previous occasions, and we hope your visit to our metropolis—which is still an infant metropolis of Canada—will be such as to induce you to come again. My remarks will be very brief, but they are not the less sincere on account of their brevity. We welcome you here. We are exceedingly proud and happy to greet you, and hope you will have a very pleasant time while you are here, and that pleasure may be joined to some acquisition of knowledge as to the resources of our country. Formerly, I am afraid, the majority of our American friends on the other side of the border considered us, as Voltaire considered Canada years ago, as occupying a region of ice and snow. I am glad to find that that idea has altogether disappeared, and some of my political friends going to the south of the border tell me, in fact, that the Americans are getting too affectionate. (Laughter.) They are getting altogether too affectionate. I dare say, and I hope and believe, that the intercourse between the people of Canada and you gentlemen, as representing a very important body from the United States, will tend still further to unite us together in feeling, as we are in blood and language and otherwise. I told a story a short time ago, which I shall repeat. It was a good many years ago now, when the Americans did not know Canada nor covet it so much as they do at present. (Laughter.) They were not so well aware of our very great merits. This story was told to me by a gentleman, now a Canadian but of American birth. He was traveling from Windsor, at the western extremity of Ontario, eastward, and he was sitting behind two American gentlemen who were evidently paying their first visit to Canada. He could not help hearing their conversation. After going a few miles eastward one of them said:—"This is not so bad a country." "No," says the other, "it is not a very bad country." After going a little further the one who had spoken first said:—"This is a fine country; we must have this country." "Oh," says the other, "I would have no objection to taking the country if it were not for the damned people we would have to take." (Laughter.) That is all gone now, and as I have already said, we believe that our good neighbors are beginning to think that our country is not so far inferior to theirs; not so far, at all events, as to disincite them to take the country even with the encumbrance of the people. (Laughter and applause.) I shall not detain you any longer, not being a miner myself, but a politician. Some of our enemies say of us that the only mining we know of is undermining. (Laughter.) But that is a falsehood, like many other falsehoods that are prevalent in this world. I wish every prosperity to your Institute, which I believe is calculated to do a great deal of good. I think science belongs to no country, nor does the practice of science belong to any country. I believe the examination of Canada by you, gentlemen, will be of very great service to Canada; and as a matter of self-interest, if it were not from higher sentiments, we greet you from the bottom of our hearts. We think, with your assistance, that is from the reports you will make, we will be able to stand still higher as a country capable of great development, and I can say that with your assistance we will be able to do that which is described in the rather profane language of the celebrated Sheridan when he went down to Manchester at the time of the construction of the great Bridgewater Canal. As you know, that is a great country for professional men like yourselves, and as far as canals and mines and the development of industries of every kind are concerned, that is a great centre. He was called upon to give a toast, and this was the toast—it is not profane, gentlemen: "Dam your rivers, sink your mines, and blast your canals." (Laughter and cheers.) With your assistance, and with the assistance of men like you, we hope to carry out these very objects. I greet you, gentlemen, with all my heart. (Cheers.)

SHERIFF SWEETLAND—I would ask the Hon. Mr. Ross, Minister of Public Works for the Province of Quebec, to address you.

HON. MR. ROSS—Mr. President, Ladies and Gentlemen: I have been present in this room before now, and I have witnessed some very severe bickerings and animosities on the subject of railways, but I must say I consider this meeting one of the most unanimous, as well as the most important, I have ever been at. There is no question whatever as to what Canada would be without railways; but on the other hand, what would Canada be if all the treasures that are buried under the surface of the earth were unknown? How could this country compete with other countries who have the advantage of experienced miners? Talking of experienced miners, I must not admit that we are inferior here in that material, nor in the ability of the few mining engineers we have. Some of them have world-wide fame. (Hear, hear). Nevertheless I think that such a gathering of able men as this is, from the different points of the continent must be doubly advantageous to themselves and a benefit, a great and lasting benefit, to us. The Province of Quebec is not at all blind to the advantages which follow from the visit of men who are not mere theorists, but who are practical men and who have already done great good to mankind, and will do still more. I recollect a tale of my childhood—for I was once a child—in which a magician enabled a certain princess to see all the veins of gold and silver hid in undeveloped portions of the globe by rubbing a certain ointment on her eyes. I say that mining engineers of the present generation can see as clearly through the earth as that princess ever could; but that ointment is not applied to their eyes, but to their brains, with hard study and comparisons of indications and results. There is no question whatever but that there are two magicians very helpful in this matter. These are geology and mineralogy—going hand in hand revealing the treasures of the earth, and to men who search for them their proper worth. I understand the Institute is based on a correct principle, by which practice is added to theory. Now, in the Province of Quebec the Premier, Mr. Mercier, is most anxious that the members of the Institute should call upon us, not as one of your generals called upon us several years ago, but as brothers. We extend a most cordial welcome to you. I might say that in asking this we are acting a little from selfish motives. It is to our immense advantage that these gentlemen come among us, as they may enable us to develop our resources. There is no doubt that the Province of Quebec and the other Provinces are very rich in minerals. As an instance I would refer to the extensive deposits of asbestos at Thetford and other portions of the eastern townships, which were unknown until a few years ago, and are now being worked and are yielding enormous profits. We extend a cordial welcome to you, and we shall be delighted to see you in the City of Quebec. (Cheers).

SHERIFF SWEETLAND—I have to regret the absence of His Worship the Mayor, but I am informed that Ald. Henderson, who is acting Mayor, is present. If he would be kind enough to say a few words on behalf of the City, we would like to hear him.

ALDERMAN HENDERSON—Ladies and gentlemen, I regret exceedingly that our friend His Worship the Mayor has found it necessary to be absent to-night. Otherwise I am sure he would be only too glad to have extended a cordial and hearty welcome to these distinguished gentlemen. I should like, however, to set my friend the Chairman right with regard to the remark which he made with respect to myself. I occupy no such honorable position as acting Mayor. I am simply an alderman in the City Council. When it was found that the Mayor could not attend I was asked to be present to say a few words of welcome to you. That I was delighted to do. I felt it would be a pleasant duty to welcome you, on behalf of the citizens of Ottawa, to this good city of ours. We are glad to have among us a number of gentlemen representing so large and influential a body as the American Institute of Mining Engineers. I trust you will find your stay among us not only pleasant but profitable. It is to be regretted that the weather is not promising well; but I hope that the warm welcome that will be accorded you, and the heartiness of your reception, will go far to neutralize that inconvenience. We welcome you for several reasons. First of all for your own sakes. We recognize the great work your Association has been doing the last twenty years. We recognize that amongst you there are gentlemen who are the highest eminence in the different branches of your profession, some of whom are of world-wide renown. We welcome you for your own sakes because we expect and hope to realise a large amount of pleasure from that social intercourse which we trust will take place between us. Again we welcome you because your visit will be of great and lasting benefit to this section of country. As Canadians we are naturally proud of our country. We look upon it as having a great future, not only in its intellectual advantages and material progress, but from the bounties of nature which are so liberally strewn around us. You have come to see for yourselves that on which we found those hopes of

material progress. Gold we do not possess in this section. Many of us slave for it, but so far it has not been taken from our mother earth in quantities sufficiently remunerative, but I think we can safely say we boast of ores, if not so intrinsically valuable as gold, which are calculated to build up a more prosperous nation than the possession of any gold mines could do. To those of you who are strangers among us—that is, who come from across the border—I desire specially to offer a cordial welcome. Strangers in one sense you may be, but in another sense you are not. We can all boast a common origin, a common language and a common mission—a mission to ennoble and assist our fellow men. Possibly in the near future there may be a closer link between us. Who can tell but what we may have a magician here to-night. We have one sitting at that table (referring to Sir John Macdonald), a gentleman who has been intimately associated with the progress of Canada—one who has seen it rise from a few scattered provinces and united and welded into this great Dominion. (Applause). It is just possible that some day he may think it time to have done with our eternal squabbles, about Commercial Union and Unrestricted Reciprocity, and think the time has arrived when he may extend his magic wand across the St. Lawrence and invite you to become part and parcel of our great Dominion. (Applause). There may be something enticing to have the stripes wiped out of your banner and have the stars encircled with a chaplet of leaves of the maple or the oak. If that does not tempt you I do not know what will. We can only trust that in the future we may live as we are doing now and have done in the past—to work together for one great end, to live in peace and good fellowship, to emulate one another's good deeds, seeking to extend the great principles of liberty, equality and fraternity. (Applause).

COL. LAV, Consul-General in Canada for the United States, briefly welcomed the Institute. An address was also presented from the Ottawa Board of Trade by the President, Mr. John M. Garland.

DR. THOMAS EGLESTON, New York—Mr. Chairman, Members of the Institute, Ladies and Gentlemen: It is my very great pleasure, in the absence of the President of the Institute, to accept on its behalf the hearty welcome you have given to the members of the Institute visiting Canada. We are not unknown to you. Many of us have very honored and intimate friends on this side of the border. We know your hospitality. Many of us have been here before, and we know exactly what we are going to receive in the way of hospitality and what we are going to see in the way of beauty in this fair land; for it is a fair land. I think I may say there is no 36 hours' railway journey in the West that equals the ride over the Canadian Pacific Railway; certainly there is no such scenery in the East. You have gold, silver, copper, coal of every kind, and you have it all in profusion, and all that remains is to get it out. It is going to come, and this fair land is going to be a very great as well as a very good land. It is not my duty as acting president to say more; but I call upon Dr. Raymond, who is Secretary of the Institute, to reply on its behalf.

DR. RAYMOND—Mr. President, Ladies and Gentlemen: I count myself fortunate to be designated to-night as one who may speak for his brethren of the Institute in reciprocation of the cordial welcome that they have received from their brothers and from the citizens of this goodly town. The brief glimpse that I have had in the few hours since my arrival, justifies me already in the conclusion that we may congratulate you upon being the inhabitants, and that we may felicitate ourselves upon being the visitors of this imperial city, and all this region in which the beauty and the wealth of nature have been appreciated by the intelligence, and developed and utilized by the enterprise of man. As I was looking over an exquisite collection of photographs in the rooms of the Local Committee, a collection which I hope, I betray no secret in saying our members are likely to become more familiar with before this meeting is past, I was struck by the casual remark dropped by my friend of the blue ribbon; possibly he thought it had no deep significance, but in my heart it struck a very profound chord. As I gazed upon a picture of lovely sylvan beauty, trees, flowing river, swift and bright cascades, he said, "That's what runs our mills." I know, gentlemen, that the fashionable poetry of the day scorns waterfalls that run mills, but to the mind of an engineer, and to the mind of a man of science, it is not beneath the dignity of a waterfall to run a mill. (Applause). A few of those here in this gathering went last summer into the far west, and among other things we visited a vast body of water that runs no mill—the Great Salt Lake, the Dead sea of the Interior, the incarnation of a type which I am glad to say is very rare in nature, the type of concentrated selfishness, receiving ever and giving never, and growing nastier and nastier all the time.

(Laughter and applause). No fish flash in its waters; where the gulls, for they have gulls over the Great Salt Lake, simply go through the motions of gulls over real water, and pretend to dive for fish where there are none, and when they have tired themselves in this exercise, fold their wings and tread along behind Mormon ploughs and hunt for bugs. (Laughter and applause). As we left that vast, bitter, useless lake, which is made perhaps to satisfy the æsthetic sense of some modern bard who thinks that nature ought not to be made useful, and we came eastward to other lakes—your lakes, my friends, and ours—which received freely and freely gave, out of whose crystal bosom runs such streams as the St. Lawrence, on whose great banks mighty forests wave and droop their pendant branches to the stream, great cities sit to lave their feet in the cool waters, the keels of commerce and the wheels of industry bless them and use them, and all down their course of a thousand miles they are swift with beauty and musical with life and instinct with power. (Cheers). But why, need I ask before a society of engineers, and the wives and daughters and sweethearts of engineers, that beauty need be divorced from us? (Cheers). Why need I ask that power must be idle? It is a slander upon Almighty God whose power in-dwelling inspires and operates the machinery of the universe. (Cheers). So I am glad to know that the waterfall which I saw to-day in the picture, and hope tomorrow to see with my own eyes, in fact runs your mills. I shall be glad to know that all the vast enginery of nature and all the hidden treasures of nature have been snatched—not snatched, but transferred into forms of beauty and of use, of higher use, for the bodies and the souls of men. (Applause). We have heard to-night from the Chairman of our Local Committee of a truth which has been somewhat ignored in higher quarters. I for one, let me say in passing, rejoice especially that we now meet again, as we have met on two delightful occasions before, beneath the banner of St. George and among the free subjects of that sovereign, who has often honored engineers, and whose long and prosperous reign will be in history most glorious as the age of great engineering achievements. (Cheers). Therefore, you will not suspect me of any irreverence or disrespect to that august lady if I criticise something in the speech from the throne, particularly because I do not suppose it was the lady, but the Prime Minister, and not the Prime Minister, but the clerk of the Prime Minister, who made some mistake in the speech—a speech in which the United States is spoken of as America, and the Queen herself, through the lips of her Minister, talked about her diplomatic relations with America. If she does not know better, she ought to. Canadians are as much Americans as we are. At least in the title of the Institute which meets here to-night, the word "American" was never intended to stop in its meaning with the St. Lawrence river, and we have given our proof of this many and many a time. In the first place, as Secretary of the Institute I collect the fees of the Canadian members just as rigidly and with just as much difficulty as from Americans. (Laughter). We take them in and we bounce them out with equal facility. Their obligations, their privileges, their rank is just the same as that of any man on our side of the line. In the second place, as though we would emphasise the continental character, or still better the cosmopolitan character of our association, we have at this time in the person of our President, Mr. Pierce, of Colorado, whose absence to-night I sincerely deplore and he sincerely deplores—a gentleman at the very fore and front of one of the branches which the Institute represents, a leading financier, inventor and administrator, and universally esteemed, and a subject of the Queen of Great Britain. (Cheers). Gentlemen, the Mining Engineers occupy a plane very high above politics.

SIR JOHN MACDONALD—Even at the bottom of the mines? (Laughter).

DR. RAYMOND—While statesmen are debating and enquiring, and perhaps intriguing concerning diplomatic or commercial relations, we have long ago established the closest of unions—the union of hearts in mutual esteem and the union of hands in common endeavor. (Hear, hear). For my part I would care nothing at all for any other union than that, and I care very little for any other union without that. If we can but remain without scism, secession or separation in the Institute of Mining Engineers, the North American Continent can behave just as it likes. (Laughter). And this union we shall maintain for the simple reason, apart from all joking on the subject, that it is a union so high that minor differences disappear. We stand under two flags, not alternately looking up to one and to the other, but honoring both always; because we are allied in the noblest of all warfare—the warfare of light against darkness, sunrise against midnight, of power against inertia, of mind against matter—and secure in the victory, in the continual, successive daily victories of this sublime warfare we look upon our nations' battle flag and see no longer the stains of human blood, but rather mingle the hues of a new heaven bending brightly over a new earth. (Cheers).

Sheriff Sweetland then vacated the chair in favor of Prof. Eggleston, Acting President, and the regular business of the Meeting was then begun. Prof. Smock read a biographical sketch of the late Dr. George A. Cook, State Geologist of New Jersey. He was followed by Dr. R. W. Raymond, who presented a similar notice of the late W. H. Seranton, of Oxford, N. J. With the aid of a few hastily gathered notes C. A. Ashburner, of Pittsburgh, paid a tribute to the late Capt. Wm. R. Jones, of the Edgar Thomson Works.

Wednesday.

Wednesday brought an additional number of members. The morning was given over to a drive to the celebrated Chaudiere Falls, and the great lumbering establishments to which they give life. The party was conducted through the large mills and factories of the E. B. Eddy Manufacturing Co., Messrs. Perley & Pattee, and other large industries. At Eddy's match factory and pulp mill the ingenious machinery was closely inspected and much admired. A visit was also paid to the Experimental Farm, where Mr. Fletcher, in the absence of Prof. Saunders, the Director, conducted the visitors to the various points of interest in, and around, this admirably conducted institution.

Afternoon Session.

THE QUEBEC GOLD FIELDS.

DR. ROBERT ELLS, of the Geological Survey of Canada, read an excellent paper on the "Mining Interests of Eastern Quebec," in which he dealt mainly with the copper, asbestos, gold, slate, and other mining work being carried on in the Eastern Townships of that Province. As we hope to be able to reproduce this paper in the REVIEW, no further mention of it will be necessary here.

MAJOR R. G. LECKIE—Dr. Ells has referred to the occurrence of gold in the Eastern Townships, and before leaving home Mr. Ives, M.P., and Mr. Pope, M.P., allowed me to take a bottle of the gold which had been gathered during the last year from the Ditton districts, (samples exhibited). This was washed from the bed of a small stream. I think it occurs within a width of one hundred feet. The rocks of that portion of the country have been described by Sir William Logan as Upper Silurian, but Dr. Ells by more recent observation classes them as Cambrian; perhaps Lower Cambrian. They are intersected by reticulating veins of quartz, perhaps running from six inches to one foot in width. At a distance of about two miles from where this gold has been gathered, a bunch of quartz was struck from which, perhaps, six hundred dollars worth of gold was abstracted, simply by hammering, without even a mortar. No further explorations have been made, and this gold has been collected by the crudest means; farmers going in there, after harvesting, and washing out the gold in a very premature sort of way. I think that within a year or so a systematic effort will be made to trace the source of the gold, and I am in great hopes that some very valuable leads of quartz will be exposed, which will form a source of great wealth to that part of the country. Dr. Ells has remarked that this same band of slates runs into New Hampshire, and this gold occurs within 20 miles of the line; so there is hopes for your part of the country as well.

DR. ELLS—I might say that for the encouragement of those who desire to investigate that district, that similar bottles of gold have been got within two miles of the line. They had a sluice running down a hill over fifty feet, and they shovelled it out with shovels and pitchforks. They did not get all the gold out you may be sure.

NATURAL GAS EXPLORATIONS ON THE ONTARIO PENINSULA.

DR. C. A. ASHBURNER, Pittsburgh, followed with a paper on Natural Gas Explorations on the Ontario Peninsula, in which he made the sweeping assertion that, in his opinion, gas would not be found on the Ontario Peninsula or in the valley of the St. Lawrence in sufficient quantities to allow of its being piped for a distance of ten miles. He thought that the possibility of finding gas in Canada was confined to the strip of land in that area, but he was disposed to question whether gas would ever be found in that peninsula to be transported in pipes of any considerable thickness for any great distance, although it might be of sufficient value to consumers in the immediate district.

DR. ELLS—I do not know anything about gas in Ontario. The gentleman who had charge of that is Mr. Coste, who left us last summer. I believe Mr. Coste has struck one well which has already furnished one million feet. That well is at Kingsville. He left the Geological Survey to take charge of it, so he must think there is something in it. I do not know whether it is to be piped or not.

DR. EGLESTON—I was told recently that gas in large quantities had been discovered on the line of the C. P. R. in the middle of the prairie. Where is it?

DR. ASHBURNER—It is in Alberta Province. I have been in correspondence with the people and would have made an examination had the bank account of my correspondent been sufficiently large. It is at Langevin station.

MR. MACFARLANE—When you come to talk of gas in that region it reminds me that about twenty years ago gas was discovered away down about seven hundred feet below the level of Lake Superior, in the Silver Islet mine; it is a fact that the miners there struck into gas, which was lit and burned for over a week at any rate. That is a well authenticated and recorded fact. The very interesting paper to which we have just listened shows that we should not be surprised at the occurrence of gas anywhere from the Devonian to those rocks of the St. Lawrence which are supposed to be the oldest Silurian rock we have. Here in Canada we have indications of gas but there may be varying compositions.

DR. ASHBURNER—There is very little difference in the composition of natural gas. The only difference is the quantity of sulphur it contains. It is almost all marsh gas.

A Member—That gas at Silver Islet might have been sulphuretted hydrogen.

MR. MACFARLANE—No; it was not sulphuretted hydrogen. It burned for a long time. The question is as to the origin of this gas. It is said that in boring down we come to certain strata that contain it, or certain porous strata which ought to contain it, and there it is in fissures or cavities; but having heard more or less of gas and petroleum in the last twenty years, it seems to me that there can be no other origin for either of these than coal. I think a very interesting discussion could be raised as to the origin of this gas. I should like very much indeed if Dr. Ashburner would give us his ideas on that subject.

DR. ASHBURNER—In answering Mr. Macfarlane's enquiry, I would simply say that the question of the origin of petroleum and natural gas has been most ably considered, more particularly by Prof. Leslie of the Geological Survey of Pennsylvania, and Dr. Newbury, the State Geologist of Ohio. There is no doubt that natural gas, resulting from the decomposition of vegetable or animal organism, has got into the rocks. We know that coal results from organisms principally vegetable, but I do not think we have any authentic case where petroleum or natural gas has been derived from coal. There is not much to show that petroleum or natural gas has any relation to coal. It was thought for fifty years after the development of the Pennsylvania oil fields that there was some connection between the oil and the bituminous deposits in the hills; but that was merely coincident that coal and oil were found in the same district. Now we get gas in northern Ohio absolutely disconnected from any coal fields, and we get petroleum in the vicinity of Florence, Colorado, where there is absolutely no oil. It thus seems that this gas and coal occur independently. All this indicates independent geological relationship.

DR. RAYMOND—In further reply to Mr. Macfarlane, I would remind members that the subject of the origin of petroleum, and of natural gas incidentally, has been very well summed up and argued upon the basis not only of American conditions, but also upon the conditions in Russia, the Crimea and elsewhere by Professor Herrfort, one of the honored members of this Institute, in his recent volume on oil, constituting one of the numbers of a botanical dictionary in process of publication in Germany. Professor Herrfort maintains, if my recollection serves me, that the sole source of true petroleum and natural gas is animal remains, and he supports that theory by reference to actual synthetic experiments, by which lards and similar animal fats have actually been transformed essentially into petroleum by proper treatment and temperature and pressure. It is an interesting summary, and I think he substantially takes the same view as Prof. Leslie and Dr. Newbury. If that be the case, we can scarcely say that coal and petroleum have the same origin, as coal is not of animal origin.

DR. ASHBURNER—In further reference to Dr. Herrfort's work, to which Dr. Raymond has referred, I would say that the argument which he advances—and I was in correspondence with him for two years,—and which he supports with most conclusive evidence, or facts, or facts gathered from experiments, is very well grounded, although not absolutely an original idea. It has gained considerable ground in America and animal organism has been acknowledged as being the basis of some of our petroleum. Dr. Chandler has referred to

this matter and has done some considerable work with respect to it; and Prof. Peekham in his work on the exploration of the California oil fields, from chemical and microscopic examination of those oils, points out the difference between the eastern oils and the California oil and showed that the latter were no doubt derived from vegetable organism. When it comes to our eastern hydro-carbons, liquid as well as gaseous hydro-carbons, we feel we are able to assert with a good deal of positiveness that the petroleum which we get in the carboniferous state, and we get a good deal of the carboniferous in Pennsylvania, some largely from vegetable, but to some extent from animal; whereas the gases or petroleum of the lower Silurian are to a great extent from the decomposition of animal remains. In California the oils were probably entirely animal in their origin.

MR. MACFARLANE—I desire to say that I have read the work of Prof. Herrfort to which Dr. Raymond has referred, and also Prof. Shedler in his recent work on oils and I am aware that the origin of these oils was attributed to animal matter. Of course, in the face of the authorities quoted I have not much to say on the subject, except to mention that the quantity of animal matter when you regard the large amount of petroleum and gas that has been produced could have been sufficient. I would further mention the fact that there does not occur in these petroleum or oils the element nitrogen to the extent that one would expect if the origin had been of an animal nature. Before resuming my seat I would like to mention that there have been some important occurrences of gas in Ontario. There was a very important well set on fire somewhere; we read about it in the newspapers as having been a very extraordinary occurrence, and the flow of gas from that well must have been very great indeed. It is a matter of regret that we have no Canadian authorities at present who are able to give this Institute any information on this subject. I think it is something we ought to be ashamed of.

DR. ASHBURNER—The gas from the Fredonia, N.Y. region contains nine per cent. of nitrogen, and quite a number of our cases do contain nitrogen.

MR. MACFARLANE—That is nitrogen in the state of gas, and that might have been derived from other sources.

DR. RAYMOND—You do not mean nitrogen of mere air mixed with gas?

DR. ASHBURNER—I mean nitrogen as part of the gas compound nitrogen.

MR. MACFARLANE—In what form does it occur if compound?

DR. ASHBURNER—I cannot speak of that, but it has been a question whether there is ammonia or not. Several analysis of the Fredonia gas show ammonia, but I have been disposed to question whether it was ammonia.

MAJOR LECKIE—I remember a discussion between Dr. Newbury and Professor Sterry Hunt sixteen years ago, and Dr. Newbury took the ground that these oils and gases were derived from bituminous shales. Dr. Sterry Hunt maintained, on the other hand, that these oils resulted from the decomposition of marine life and was to be found in the limestone of marine region. I think there is a good deal in what my friend Mr. Macfarlane says about the connection between oil and coal and carboniferous formation. What has become of the immense quantities of volatile matter given off in the change of bituminous coal into anthracite? How many millions of tons of volatile matter must have been given off.

DR. ASHBURNER—We never find gas in the vicinity of Anthracite.

MAJOR LECKIE—It may have been carried off and held in reservoirs. From the fact that Professor Eggleston mentions that of gas is found at Langevin near the base of the Rocky Mountains is important. You come there to where the bituminous coal is being converted into anthracite. I do not see it is at all unreasonable to suppose that the immense volumes, amounting to millions and millions of tons of volatile matter, which have been given off are bottled up somewhere. If not where has it gone?

MR. MACFARLANE—There are not only the volatile products that come from the bituminous coal to be accounted for, but there are also the products from the change of vegetable matter into coal. What we have also to account for is where the products of that change have gone. I mean the products of the change of peat, we will say, or vegetable matter as it originally was, to the coal. There must have been a very large amount of volatile matter produced, and it is quite

reasonable to suppose that this may have been held in reservoirs under continuous pressure.

DR. ASHBURNER—I think Mr. Macfarlane's and Mr. Leckie's views are undoubtedly correct if they will expand them into the theories and explanations so carefully described by Prof. Leslie and Dr. Newbury. There is no rock that is absolutely free from coal. You can find coal absolutely in every rock formation; but commercial coals are confined to a distinct formation. I think Sir William Logan pointed out the occurrence of carboniferous material in the Laurentian rocks of Canada, but the formation of oil, gas and coal, is practically in the same sequence or comes in the same category of phenomena.

MR. INGALL—There was an attempt made to collect some of the gas at Silver Islet, but we never happened to be around when the flow occurred.

PROF. SMOCK—I should like to ask Ashburner if there has not been natural gas found in sufficient quantities for commercial purposes in the Trenton limestone in Lewis County, N.J. The papers report the fact.

DR. ASHBURNER—That is immediately west of the Adirondacks; there had been quite a number of finds. Since my paper of two years ago in which I referred to this there have been several, but I have not known of them in commercial quantities. I know of no locality east of Fulton, N.J. As to the possibility of finding it in the lower part of New York State, I think it is not encouraging, because it does not look as if the rocks were sufficiently free from cracks to prevent the gas from escaping.

PROF. SMOCK—I should not expect it, but the newspaper reports from time to time have said so.

PROF. EGLESTON—What towns have they been found in?

DR. ASHBURNER—I do not just recollect. It is just west or south-west of the outcrop of Trenton limestone and in the Hudson River district.

The Institute then adjourned until two o'clock the following afternoon.

RECEPTION AT THE RUSSELL HOUSE.

It was at first proposed to tender the visitors a public Reception in the Senate Chamber, but the Government having negatived the proposal, the idea was abandoned in favor of a smaller affair in the Russell House. This proved a decided success, very many of our representative citizens turning out to spend an hour or two with the visitors. Lady Macdonald along with the lady friends of the local committee received the guests in the Ladies' Parlor. The string band of the Governor General's Foot Guards furnished music, and dancing was heartily indulged in up to a late hour.

Thursday.

Thursday, like its predecessor, proved wet and miserable, indeed during the early morning a considerable quantity of snow fell. Parties were, however, conveyed in the forenoon to the Geological Survey Museum, the Parliamentary Library, the Senate, House of Commons, the works of the Canadian Granite Co., and other points of interest. The Geological Survey Museum was pronounced most complete, well arranged, and a credit to the country, but the limited space at the disposal of the Director was not commented upon in so favorable terms. The visitors were delighted with the Parliamentary Library, and the handsome appointments of the various public buildings.

Afternoon Session.

NOVA SCOTIA IRON ORES.

MR. B. T. A. BELL, read a paper on the Geological Relations of the Nova Scotia Minerals, written for the meeting by Mr. E. Gilpin, Jr., Deputy Commissioner of Mines, Halifax. As the paper will be published in full at a later date, details are withheld.

DR. C. A. ASHBURNER—It was not my privilege to read the latter part of this paper, but I will make a suggestion which the secretary can carry out in correspondence. It would be interesting if Mr. Gilpin could extend his paper to the extent of referring to the geological relationship, more particularly of the iron ores of Nova Scotia and Cape Breton. Several years ago my attention was directed to the iron ores of the eastern shore by some iron masters of Pennsylvania, with the view of mining those ores and importing them into the States. At that time, with Mr. Gilpin's assistance, I collected a large mass of material, but the Pennsylvania people did not invest in the enterprise. It seems to me that if the attention of iron men could be directed to the

possibility of finding large deposits on the eastern shore there would be a great commercial demand for them, particularly the ores along the eastern shore, along the Bay of Fundy, and more particularly in the vicinity of Digby Bay. I think it would be a very acceptable thing, not only to the members of the Institute, but to a great many of our commercial iron men in the States, if this paper could be elaborated to treat, not only of the geological relationship of iron ores of the eastern shore, but to give some suggestions as to the possibility of our obtaining ore for consumption in the States—iron ores sufficiently low in phosphorus and high in iron to compete with the ores in Pennsylvania.

PROF. EGLESTON—I would like to add my request that this be done. I had occasion during the morning to look over iron ore in the museum, and I was astonished that such large quantities are found low in phosphorus and high in iron. The iron men of the States would be very glad to get it, if members of the Institute would only let the character of the ore be known.

MR. J. C. PLATT—I would also ask Mr. Gilpin to bring out the question of titanic acid in these ores.

SILVER ORES OF THE PORT ARTHUR DISTRICT.

MR. E. D. INGALL next occupied the attention of the meeting with a talk upon the Silver Ores of the Port Arthur District, which was illustrated with drawings and slides exhibited by lantern. The paper was followed by some appropriate remarks by Mr. Thos. Macfarlane, who as everyone knows, was one of the first discoverers of the famous Silver Islet mine.

GOLD MINING IN NOVA SCOTIA.

MR. JOHN E. HARDMAN, Oldham, N.S., followed gave a most interesting address on the "Methods of Gold Mining in Nova Scotia." As the paper, like Mr. Ingall's, will be supplemented with more data before publication, we regret to be unable to reproduce it now.

MAJOR R. G. LECKIE exhibited a number of very nice samples of gold from the Montague mine, Nova Scotia, the largest piece of which, he said had been carefully weighed and valued at \$1,100. For two years or more, on account of differences among the shareholders, the mine remained idle, but ultimately the ownership had passed into the hands of Mr. Charles Annand, of Halifax. The vein runs from eight inches to two feet in width and has been opened for a length of 600 feet. In this distance there are three streaks of rich quartz, dipping at an angle of 20°. Further east at 170 feet the second streak was struck, 80 feet from the surface. The third from which the specimen exhibited came, about 500 feet from the first, was struck at a depth of 100 feet from the surface. The deepest point yet reached is only 175 feet. The large piece carries considerable gold, and shows the width of the vein where it becomes rich. The smaller piece shows sulphides of copper, lead and zinc associated. These are characteristic of the richest veins in the Montague district. Arsenical pyrites is found in specs and nodules in the foot-wall, some of which are very rich in gold. In the vein itself a peculiar feature is the regular occurrence of arsenical pyrites carrying little or no gold. From 30 tons of quartz crushed last month, 174 ounces of retorted gold were obtained, exclusive of what passed away with the tailings. In addition to this, 100 ounces are locked away in the mill, and we have before us now 130 ounces in these specimens. Altogether, therefore, over 400 ounces were carried in the 30 to 31 tons of quartz raised last month. When the vein reaches its maximum thickness of two feet it becomes impoverished and yields only 6 to 7 dwts. per ton.

DR. RAYMOND—Did they treat that arsenical pyrites by itself?

MAJOR LECKIE—It is saved now in the tailings. That which is on the foot-wall is rich in gold, but the pyrites found in this vein overlying this gold is very poor.

PROF. EGLESTON—The mispickel?

MAJOR LECKIE—Yes; but when you get these nodules or mispickel off the foot-wall—that is outside of the quartz—they carry considerable quantities of gold. You can break the mispickel, and you find it held together by gold. I might say that from 30 tons of quartz crushed last month 100 ounces of gold were retorted. We have some 130 ounces here in these specimens, and altogether over 400 ounces were carried in the 30 or 31 tons raised last month. When the vein reaches the maximum it yields but six to seven dwts. per ton.

DR. RAYMOND—Would that pay?

MAJOR LECKIE—Yes; with the facilities we have for water power, and considering the high character of the gold. It is worth from \$19.50 to \$20 per ounce.

PROF. EGLESTON—You do nothing there more than direct Amalgamation.

MAJOR LECKIE—No; not to my knowledge. We are not working tailings. There is no abstraction of gold by chemical methods.

MR. JOHN E. HARDMAN—There is no attempt at working the sulphides on any scale; nor is there any attempt at Concentration.

MAJOR LECKIE—There is natural Concentration.

MR. HARDMAN—In the majority of cases they are sluiced away and pass into the sea.

PROF. EGLESTON—I was going to tell about a mill in California where they made Concentrations up to \$300, but I do not suppose my story is good for anything.

DR. PETERS—I had heard a good deal about the Nova Scotia gold mines, and I thought from the statements made that that was just the place I was looking for, but I found them just about as sharp men as you find anywhere. If any mill man went down there under the supposition that he was going to show the natives anything he would be mistaken.

PROF. EGLESTON—Some years ago in Nova Scotia there was a chlorinating mill, and they sent more gold up the chimney than they recovered. They used too much salt. I should like to know where that mill was.

MR. HARDMAN—I have only been there four years, and I have not heard of any attempt at chlorination there.

PROF. EGLESTON—This was chlorination very similar to that I saw in California. They either covered the gold with oxide, or they sent it up the chimney as chloride.

MAJOR LECKIE—The only chlorination I know of was at Capelon, and was done by Henderson Bros.

PROF. EGLESTON—Did they have Longmead?

MAJOR LECKIE—That was the origin of all these methods—using iodide of potassium.

PROF. EGLESTON—They used to use iodide of zinc.

A paper on the subject of fine and float gold by Prof. Egleson, in which Dr. Peters, Dr. Raymond and others took part, terminated the session, which adjourned until 8 o'clock in the evening.

EVENING SESSION.

DR. E. D. PETERS, Jr., general manager of the Canadian Copper Company, opened the meeting with a graphic and most interesting description of the mines and works of his company at Sudbury. This was undoubtedly the most important paper of the meeting. A verbatim report of the paper and the subsequent discussion upon it is given our readers in another portion of this issue.

DISCUSSION ON CANADIAN PHOSPHATE.

DR. ROBERT BELL, of the Geological Survey of Canada, introduced the subject of the Phosphate Deposits of Ottawa County in a brief address, in which he dwelt specially upon the geological relations of these deposits, illustrating his remarks by some excellent crayon and water-color drawings.

MR. J. LAINSON-WILLS, Buckingham, followed with some remarks on the associated minerals found in connection with phosphate, and pointed out that while the occurrence of the mineral might be irregular, there was one point of regularity, namely, that of the continuity of the formation over a large extent of country.

CAPT. R. C. ADAMS, Montreal—I have been asked to say a few words on the practical side of the phosphate business to supplement the interesting scientific statements you have just heard. If the hour was not so late I might have been much pleased to say a good deal on this subject; but I hardly like to trespass on your time to the extent I might do. I will therefore merely allude to a few points. You have heard in graphic scientific language from Dr. Bell how irregular these deposits are, and you have seen from his diagrams their peculiar nature; that they are here and there and everywhere, and not as often everywhere as we would like. When this industry was started, you may know, it was carried on by farmers. In their spare time they picked at this little outcrop of phosphate or that which occurred on their farms. One of these was asked what he thought of phosphate occurrences, and he gave this description:

"It is long and it is short; it is wide and it is narrow; it is deep and it is shallow; it is thick and it is thin; it is here and it is there; you have got it and you haven't got it; you see it and you don't see it." Then he used some terms which are technical. He wound up by saying: "It is — of the — and I won't have a — thing to do with it." (Laughter.) That expressed in forcible terms his opinion of the mode of occurrence of apatite. The occurrences differ in the two sections where it is mined — in the Ottawa District and the district between Perth and Kingston. In the Ottawa region it occurs more in masses through the rock; whereas in the Kingston district it is found in distinct veins. They are smaller in size than those found in the Ottawa district and this has led to different methods of mining in the respective districts. In the Ottawa district the steam drill comes in very well and large masses can be blown down and the phosphate separated. While in the western district it is not so appropriate to use the drill, as I have found to my cost. I have squandered a good deal of substance in riotous rock drilling. I thought I would depart from the old system, which Mr. Hardman has described as the flour-barrel-and-windlass system prevailing in Nova Scotia. I got an Ingersoll Compressor, but on using it found we had to break so much rock that the work became too expensive, and that it was cheaper to work by hand. The scientific phases have been described by Dr. Bell and Mr. Wills, and although you might think the commercial side does not bear on your sphere, it certainly does so, inasmuch as your reward depends on it. Some of the troubles we have had to encounter in the commercial field have hindered our enterprise here. With regard to ordinary mining we certainly want your assistance. Things have been done heretofore in these mines without the assistance of science, and we wish we had some men like Dr. Peters to apply a little thought and brains in developing the best methods of working the mines. I know that mining engineers never believe anything favorable that is said with regard to mines, and they do not always believe what they see, and you will still believe that as we raise phosphate there are some advantages that we modestly refrain from mentioning. The commercial points are these: When this phosphate is shipped we sell it at what we think is a good price. The first thing we discover is that there is a discount of $2\frac{1}{2}$ per cent. That comes off. Then it is sent over to the other side under a guarantee that it is to go a certain percentage. This is determined there in samples as the stuff is discharged, and it is a contest of wits and chicanery between the two parties. The buyer's agent and the seller's agent have the drawing of these samples. The buyer's man has the most experience because he receives large quantities, while the seller's agent may handle but a few cargoes in a season. The buyer's man is the most skilful. These two samples are sent to different chemists and the astounding fact is presented that the buyer's chemist is generally lower than the seller's. In an entire season's shipments, seven out of eight, the buyer's chemists would be lower than the seller's, and in some cases as much as three and a half per cent. I have seen as high as 3.57 difference, and another 2.52. This is a problem between mind and matter which is overwhelming. When you remember that our success depends upon the correspondence of the analysis with the guarantee, you see how great is the uncertainty where there is a possibility of 3.5 variation between the buyer's and the seller's chemist. If the cargo is rejected we get into a great deal of trouble. It is taken off by the buyer into his works before the quality is determined. If it goes $\frac{1}{2}$ or 1% below the guarantee it is rejected, and we are told they cannot use such worthless stuff. To take it away involves great loss. I know of a shipment this summer which was rejected only $1\frac{1}{2}$ % below the guarantee. I know of another reduction of £1 10s. where a fall of two per cent. took place. I think it is a mistake to have the article pass into the buyer's control before its value is determined, but it is a problem how to remedy this. I will not detain you by going into other points in this direction; but I want to say one thing with regard to the future of Canadian phosphate, and I hope the chemists among you will give it attention. That is with regard to crude phosphate. Many believe it to be valuable in its raw state. We have good authority for saying that superphosphate reverts and becomes to some extent insoluble, and if phosphate be ground fine it may be that in being acted upon by the carbonic acid of the soil, or juices of plants, renders it available for plant food. I have seen remarkable results from it. I went into a barnyard where they had used this Canadian phosphate for years and I saw some beans which reminded me of an advertisement in Boston. One man who was very corpulent was represented as saying: "I dine at Blank's while the other, lean and cadaverous, replies, 'I do not.'" These phosphate beans were immense fellows, climbing to the top of the poles, while those which had not been so fed were miserable little things. In this case it was combined with suitable manure, which perhaps occasioned some fermentation, and in that way made the phosphoric acid available. We feel that if this

fact is established it will be of immense benefit to our industry and to the progress of Canadian agriculture. (Applause.)

MR. P. WURZBURGER, Antwerp, followed with a few remarks in which he expressed himself as most favorably impressed with the great future of the phosphate industry in Canada, judging by the progress being made in the development of the mines which he had visited.

MR. W. H. HUTCHINSON, London, Eng.—In coming here I came more as a listener than intending to speak, but as I have heard a few words on the commercial side of the question I may reply to some of them. I represent a firm of fertilizer manufacturers in London, England, of some importance, and buy large quantities of phosphate. This is the first time that I have heard of any great difficulty on the other side. We buy very large quantities of South Carolina phosphates as well as Belgian and French phosphates. They are taken to our works and sampled by our chemist. The sample of the seller goes to another chemist, and they usually agree. The only time we have difficulty is when foreign chemists come in, who have slightly different methods of determining the phosphoric acid. Then differences do occur; but with the chemists in England there should be no difficulty at all; certainly not more than one per cent. I think if you take a good respectable chemist, such as those of the Royal Agricultural Society, and others of world-wide fame, there should be no question of *mal fides* as there is in this case. The Canadian phosphate mines supply about 20,000 tons annually to England, whereas we import from South Carolina, France and Belgium from 270,000 to 300,000 tons. So you see what we get from here is quite immaterial. Still the phosphates that come from Canada are highly appreciated, and I think the industry has a great future. The only thing is to remember this: The farmers in Great Britain are many of them very poor, and we have to sell to them at very low prices. We must, therefore, buy on the best terms, and unless the Canadian phosphates are sold as those of South Carolina and other countries it cannot find a place in the English market. We must bear that in mind. I wish the industry here every success. I have been here now about a fortnight, and everywhere I have been received with a great deal of hospitality. I have been afforded every facility for looking through the mines, and I can only express my thanks to everybody for the way in which I have been received.

MR. H. B. SMALL, Ottawa—The Minister of Agriculture, the Hon. Mr. Carling, has during the past few years given particular attention to this question of the utility of crude phosphates as a fertilizing agent, and has asked the directors of the Government Experimental Farms to make tests with highly pulverized phosphates with the object of ascertaining what results might be expected from various crops. These experiments have been in progress over two years, but the actual results are not yet known. Some of them will probably be tabulated and laid before the House during the next session of Parliament. Experiments made by private individuals in this locality have been rewarded with a good deal of success. As Captain Adams has said, if highly pulverized phosphate be mixed with other suitable manure, such as that known as black or swamp muck, containing a higher percentage of acid than ordinary soil, good results are more quickly produced. Pulverized phosphate by itself would probably take years to produce a good effect, whereas when mixed with suitable manure, or soil having acid in it, results are had in a short time. I understand that Capt. Henwood, of the Emerald mine, has used fine ground phosphate with very great success. Last year some potatoes were brought to my notice which had been grown near Buckingham. Half the patch had been sown pretty thickly with pulverized phosphate, and the other half with ordinary stable manure. The potatoes where the phosphate had been put were much larger than the others, and perfectly clean, while the others were scrubby. I believe myself that crude phosphate in a pulverized state will come to be very largely used by our agriculturalists in combination with stable manure.

PROF. EGLESTON—I wish to say that some years ago I had occasion to make some experiments respecting the action of felspar on the soil. I commenced with orthoclase, and ground it from the size of a pea to the fineness of flour. The effect it had was almost like guano. Experiments have recently been made with regard to the action of organic acids on soils and rocks, and I believe these experiments show that organic acids act more powerfully than mineral acids. If the phosphate is ground fine enough, it does seem that if felspar would act in this way phosphate would behave in a similar manner.

The hour being late it was reluctantly decided to have Mr. John Birkenbine's paper, "The Possibilities of the

Manufacture of Iron at Ottawa," read by title. The other papers submitted to the meeting which were not read, but which will appear in the Transactions are: Gold Quartz, by W. M. Curtis, Detroit, Mich.; Notes on Some Coals in Western Canada, by W. Hamilton-Merritt, A.R.S.M., Toronto; Stamp Mills, by John Hayes Hammond, San Francisco, Cal.; Ventilation, Progress and Cost of the New Croton Aqueduct, by J. P. Carson, Dobbs Ferry, N.Y.; The Wear of Rails as Related to their Section, by P. H. Dudley, N.Y.; The Columbia Iron and Steel Works, Pittsburgh, Pa., by G. W. Maynard, New York; The Physical Properties of Aluminum, and Comparison of it with other metals, by W. J. Keep, Detroit, Mich.; Phosphorus in Cast-Iron, by W. J. Keep, Detroit, Mich.; The Davis-Colby Roasting-Kiln, by S. G. Valentine, Lebanon, Pa.; Commercial Economy, by Dr. R. W. Raymond, New York; Remarks on the Metallurgy of the Tellurides, by Frank Clevis Smith, Ann Arbor, Mich.; The Huanita Mining District, State of Morales, Mexico, by G. W. Maynard, New York.

This terminated the business of the Meeting.

Friday.

EXCURSION TO THE PHOSPHATE MINES.

The members of the Institute, accompanied by a number of prominent citizens, in all about 100 ladies and gentlemen, paid a visit on Friday to some of the phosphate mines on the Lievres river. Early in the morning the party was conveyed by special train to Buckingham, where the steamers *Agnes* and *High Rock*, with a large scow specially fitted up for the accommodation of the party, were found in readiness to take them to the mines. Despite the bleak, bitterly cold weather which prevailed, the sail up the picturesque river was greatly enjoyed, and many were the expressions of delight at the charming scenery decked out on every hand in all the gorgeous splendour and varied hue of its autumn tints.

At the Little Rapids, twelve miles from Buckingham, the mines now being developed by Mr. W. A. Allan, of Ottawa, were first visited. Many of the party descended the shaft and closely examined the various levels at which large masses of rich green phosphate are prominently exposed. After inspecting the engine house, cobbing machinery, and the other plant and buildings, a return was made to the Landing, where a large marquee had been erected, and an excellent lunch was served. A number afterwards took the steamer and ran down to the Emerald mines, operated by the Ottawa Mining Co., where Capt. Henwood, the genial superintendent of the mines, received and escorted them through the various workings of this old and richly productive property. Others spent an hour examining the large lock and dam in course of construction by the Government contractors, the Messrs. Poupore. Here several of the ladies greatly enjoyed a run down the rapids in a canoe.

The return journey was beguiled with dancing, tug-of-war and all manner of diversion and entertainment. At Buckingham the good ladies of that hospitable little village had thoughtfully provided steaming hot coffee and other refreshments which were most heartily enjoyed after the somewhat cold experience of the river. Ottawa was reached a little after eight o'clock. Special thanks for the thorough success of this excursion are due to the mine owners and managers at Buckingham, and particularly to Mr. J. Keith Reid, whose untiring efforts to promote the enjoyment of everyone cannot be too fully appreciated.

EXCURSION TO SUDBURY.

The following members took advantage of the excursion to Sudbury leaving Ottawa by the midnight express: Messrs. F. Macdowall, Dr. R. W. Raymond, Professor Sharples, M. N. Langdon, C. A. De Camp, A. W. Newell, Major R. G. Leckie, L. Holbrook, Thos. Macfarlane, J. T. B. Ives, Dr. E. D. Peters, Lieut.-Col. Anderson, C. E., and Dr. Robert Bell. As the majority of these were most desirous of participating in the series of excursions arranged for the following week through the Province of Quebec, only some five hours were spent at the mines and works at Sudbury, but under the able guidance of Dr. Peters this proved amply sufficient to give the visitors a thoroughly good impression of the nature and extent of the copper, and particularly of the rich nickeliferous deposits being so extensively operated by the Canadian Copper Co., the Dominion Mineral Co., and other concerns in operation there. By making close connection with the returning trains, the party was enabled to join the other members at Montreal on Sunday evening, in time to join them on their trip to the Eastern Townships. It was most unfortunate, and none regret it more than the Local Committee at Ottawa, that the elaborate programme arranged for the

EXCURSION TO PORT ARTHUR AND DISTRICT

had most reluctantly to be abandoned at the last moment. It should be stated that when Mr. Bell, Secretary to the Committee, submitted the plan of the proposed excursions to the Council of the Institute, Dr. Raymond

replied that the greater number of those visiting Canada had signified their intention of taking advantage of this trip to the Port Arthur silver mines. The people of Port Arthur nobly responded to the invitation from the Ottawa Committee to welcome them and went to a great deal of trouble in arranging the following elaborate and complete programme for their reception and entertainment:—On Monday, October 7th, the party was to arrive and be met at the station by the members of the committee, who were to accompany them to the mines, proceeding by train to Murillo, where, at 4 p.m., conveyances would be in waiting to carry the party to the mines. The Beaver would be reached at 6 p.m. That night would be spent at the hotel. Tuesday would be devoted to a minute inspection of the Beaver, Badger, Elgin, Porcupine and adjacent mines and silver mills. Wednesday morning would be given to the journey from the Beaver to Silver Mountain, the afternoon and Thursday morning to the Shuniah Weachu, West End and Crown Point mines. A detachment could visit the Whitefish Lake group or the Mink Mountain, Silver Fox, Silver Glance, Wolverine and Queen mines. Thursday afternoon the homeward journey would be commenced, spending another night at the Beaver. Friday morning the party would drive to the Kakabeka Falls, where an informal luncheon would be prepared, and Port Arthur would be reached at 4 p.m. After supper at the Northern an informal reception would be held. Saturday, the last day, would be occupied by a visit to that famous historical spot, Silver Islet, and at 2.30 p.m. all would be homeward bound, on a C. P. R. train for the east.

The weather, however, during the meeting was so inclement and forbidding that when a canvass of the members was taken on Friday night a very large number were disinclined to undertake the long journey, and indeed only some twelve, of whom the greater number were Canadians, were found willing to go. A meeting of the committee was hastily called together, when it was unanimously decided that it would be manifestly unfair in the circumstances, to put the hospitable people of Port Arthur to so much trouble and expense on behalf of such an insignificant party, and the trip was accordingly reluctantly abandoned. When Mayor Gorham heard of the decision he promptly wired that even if twelve came they would be fittingly received and entertained, but the message came too late, for the Sudbury party had gone west and the remainder were in Montreal. We trust this statement of the facts will eliminate the harsh and unfair judgement of some ignorant persons who have published that the failure of the trip was entirely due to the indifference of the Ottawa Committee.

In view of this unfortunate occurrence—the only hitch we may say in the whole programme of an eminently successful Meeting—the committee will return to the Ontario Government a large portion of their liberal Grant, from which only a *pro rata* rate will be deducted for operating expenses, as well as the cost incurred by the trip to Sudbury. We now hasten to describe the

Excursion to Montreal, the Eastern Townships and Quebec.

(By A. S. Bestus).

The recent visit of the American Institute of Mining Engineers to our city is one which, taken in connection with the several excursions with which it has been associated, should be of the greatest importance not only to the mining industries in our immediate vicinity, but to those of the neighboring Province of Quebec. With the exception of the unfavorable condition of the weather, which, unfortunately, the local committee could not control, it may safely be said that not only the Ottawa meetings, but these several excursions were successful in the highest degree, and it is hoped that our visiting friends and brethren of the profession will carry away with them many pleasant remembrances of their trip which will not speedily be forgotten. The gentlemen who composed that distinguished body represent not only the various mining industries of the country, such as gold, copper, silver, iron, coal, etc., but also number many who are intimately connected with those industries, viz., manufacturers of all kinds of mining plant, such as steam drills, smelting works, and in fact all kinds of engineering machinery, and we trust that during the few days they have spent with us many facts have been presented to their more immediate attention, which, if not entirely unknown to them before, will give them a much broader idea of the extent and value of some of the leading economic minerals of the country, both as to their mode of occurrence, the great value of the mineral wealth of the Dominion, and the great inducements presented at many points for the investment of capital judiciously applied and skillfully administered. While with limited time at their disposal it was of course totally impossible to show them even a small part of our resources in this direction, sufficient has, it is hoped, been done to give them some slight impression of the growing importance of Canada from the miner's standpoint, and the time and money so generously spent by our several governments have, we feel, been well and judiciously expended.

The excursions contemplated during their visit with us were three, viz.: that to Sudbury and Port Arthur, of which, unfortunately, it was found impracticable to carry out a part of the programme; that to the phosphate deposits, in which all participated; and that to the Eastern Townships of Quebec. This last may be said to have been eminently successful, and many points of interest were presented, some of which at least were new to many of the party.

IN MONTREAL.

Leaving Ottawa by the 8 a.m. train on the Canada Atlantic Railway the excursion eastward, which numbered nearly forty persons, including ladies, had a pleasant run to Montreal, a special parlor car being set apart for their accommodation *en route*. Here, though scant notice of their coming had been received, the visitors were kindly received by acting Mayor Perreault, Aldermen Wilson, Dufresne and Rolland, City Surveyor St. George and other prominent citizens, by whom carriages were provided and the entire party driven to the St. Lawrence Hall. On arrival a short address of welcome was tendered the visitors by Mr. Perrault, and replied to by Prof. Eggleston, of New York, and by Mr. B. T. A. Bell, the genial secretary of the general committee at Ottawa, to whose indefatigable exertions much of the success of the excursion must be attributed. A kind invitation was at the same time presented through Prof. Bovey, of McGill University, from Sir Wm. Dawson, to visit the Redpath Museum as well as to a Reception by Sir Wm. and Lady Dawson at their college residence in the evening. Lunch over the party again assembled and were escorted by the Mayor and aldermen, with others, in carriages provided for the occasion, through the principal portion of the city, then to the Redpath Museum, and subsequently along the beautiful mountain drives to the mountain park where a nicely appointed luncheon had been provided by the city fathers for the entertainment of their visiting friends. Though the weather was chilly, the drive, new to many, was thoroughly enjoyable, and the magnificent views that were presented at various points along the drive, and from the foot of the mountain called forth many hearty expressions of admiration on all sides. At the restaurant happy speeches were made by several of the aldermen, and replied to in well chosen words on behalf of the Institute by Mr. J. C. Platt of Waterford, N.Y., and Dr. Ashburner of Pittsburgh, the whole entertainment being a delightful surprise throughout. A point which particularly delighted the visitors was the magnificent fountain in Victoria Square, which played for some time during the drive, and forcibly impressed all who saw it with the immense head of water with which the city is provided in the event of fire, and for the general purposes of the city supply.

In the evening in response to the cordial invitation of Sir William and Lady Dawson, a considerable number attended at their residence, when a very pleasant hour was passed, the party returning to their headquarters highly delighted with the splendid hospitality which had been extended to them during the day and at the very outset of their eastern excursion.

Sunday was a day of rain. In spite of the disagreeable weather most of the visitors attended worship at some of the many churches for which Montreal is famous. In the evening a cordial invitation was extended to the engineers by the Hon. Mr. Mercier to a reception at his own house on St. Denis street, which in spite of the fact that many were tired and had preparations to make for an early start next morning, was responded to by a dozen or more. Among those present to receive them with the Premier were Mr. Robidoux, M.P.P., Mr. James McShane, ex-Minister Public Works for Quebec, and Mr. Wainwright, of the Grand Trunk Railway. A couple of hours were pleasantly spent in discussing the aim and work of the Institute, after which Mr. Wainwright cordially tendered on behalf of the Grand Trunk Railway, a free Pullman service and transportation to Quebec and return, for as many of the members as could accept it, that they might inspect the scene of the late disastrous rock slide and view the other attractions of that historic old city. Mr. Mercier kindly promising them the hospitality of the city during their brief visit. It is needless to say that those of the engineers who attended Hon. Mr. Mercier's Reception on Sunday evening were delighted with the courtesy and hospitality they experienced, and came away with pleasant feelings towards all concerned.

AT CAPELTON COPPER MINES.

Monday morning opened dark and threatening. Jupiter Pluvius was evidently to the front, but in spite of the rain there were no laggards when the time for departure to the train for Sherbrooke was announced. The party during Sunday was augmented by the arrival of several of the members who had gone west to Sudbury from Ottawa on Friday night and returned to take part in the eastern excursion, and nearly fifty persons embarked on the two Pullmans provided for the Townships portion of the programme. The heavy rain in no wise served to damp the happy spirits of any on board, and the best of good fellowship prevailed. All seemed determined that

in spite of adverse circumstances the trip east should be both pleasant and profitable, whatever the weather prophets might say. The 100 miles to Sherbrooke was soon travelled, and on the arrival there the visitors were met by the Sherbrooke committee, headed by Mr. R. N. Hall, M.P., Col. Lucke and others, the warmth of whose welcome speedily put to flight any dullness which the incessant rain might have provoked. Carriages were in waiting, and the whole party were speedily transferred to the Magog House, where a well appointed lunch and the best of good feeling soon made everyone as cheerful as possible. Cwing to difficulty of transport and train service the programme was of necessity changed slightly at this point, and it was decided to visit the copper mines at Capelton in the afternoon of Monday and proceed to Thetford and points of interest on the line of the Quebec Central Railway on Tuesday. An engine was therefore attached to the Special, and the whole party proceeded to the Eustis mines, where the general manager, Mr. John Blue, was on hand to render any assistance in his power, and to furnish any desired information concerning the workings either above or beneath the ground. Cwing to the heavy rain it was impossible for the ladies to visit these interesting works, while the magnificent scenery for which this portion of the township is celebrated, had perforce, also to remain invisible. The gentlemen, however, visited the smelting works which have lately been put in working order, and then arraying themselves in all kinds of motley garments known to mining men, a number explored the deep workings for which this mine is famous, to a depth of nearly 1500 feet, viewing with much interest the immense body of ore which is now being worked so successfully and which is reported to have in places a thickness of from 50 to 60 feet. The greater part of the output is shipped in the raw state to the acid works near New York, but about 1,000 to 1,200 tons per month are smelted on the spot, the sulphur, which represents about 40 per cent of the ore, being burned off and wasted. The ore contains a small amount of silver, from 3 to 4 per cent, which forms an important feature in the value of the output.

The adjacent mines of G. H. Nichols & Co., with which are connected extensive works for the manufacture of sulphuric acid and superphosphate, were not thrown open to the inspection of the engineering party, but as the character of the ore and the conditions of its occurrence are presumably the same at both places, the mines being located on what is regarded as the same vein, the real object of the visit was obtained. The return to Sherbrooke was pleasant in spite of the rain, and after a cheerful supper and an impromptu concert by several members, in the train, which was side-tracked for the night, and which made the evening pass most pleasantly, all turned in for the night, delighted with the first day and with their first acquaintance with the genial people of the Eastern Townships, and more especially with the welcome which had been extended them by the hospitable city of Sherbrooke.

VISIT TO DUDSWELL AND THE ASBESTOS MINES.

Tuesday morning the heavy rain clouds seemed to have nearly exhausted themselves. Fitful gleams of sunlight appeared at intervals and the indications were that a tolerably fair day would be afforded for the trip to the celebrated mines of Thetford and Coleraine and the Dudswell Lime works. The former were of special interest to the members of the Institute from the fact that they are really the only mines of the kind worked to any extent in America. The mineral is not a true asbestos or hornblende, but is a chrysotile or fibrous serpentine, and occurs in veins, which traverse the serpentine in all directions, its mode of occurrence being of particular interest to many of the visitors.

After a comfortable breakfast at the Sherbrooke House, rendered necessary by the length of time which would have been required to feed so large a party in the Pullman buffets, the Sherbrooke excursion committee, consisting of Messrs. R. N. Hall, M. P., Buck, Lucke and Mitchell and others, took charge of the party. A dining car, improvised for the occasion and well stored with a magnificent lunch provided by the local committee and by the managers of the several mining centres was attached to the Pullman train, and at 8.30 the excursion steamed out of the station of the Quebec Central Railway, matters being greatly facilitated by the courtesy of the general manager of that line, Mr. Frank Grundy. The party was here augmented by the presence of a number of Sherbrooke's pleasantest people, both ladies and gentlemen, and by the managers of the several mines at Black Lake and Thetford, including Messrs. King, Sheridan, Murphy and Frechette, who had come down the previous evening in order to become better acquainted with the distinguished visitors and to better extend to them the hospitalities of the mining section. A pleasant ride through the charming scenery of the St. Francis valley brought the excursion to its first stopping place, the Lime Works of the Dudswell Lime and Marble Company, where the four new kilns of the Dominion Lime Co. were inspected with great interest. These kilns, which are four in number, have a daily capacity of 300 barrels each, and are supplied with rock

from a splendid quarry adjoining, the stone being hauled by train to the platform and dumped direct into the kilns. This lime is celebrated for its great purity and is surpassed by that of no other lime works in Canada or the adjoining States, the amount of foreign matter being not more than one per cent. At the Upper Lime Ridge Works, half a mile distant, owned by the same Company, six additional kilns are in operation. The face of the quarry here is about 90 feet in height and close to the kilns. The aggregate daily capacity of these works when all the kilns are in operation is 3,000 barrels, and the owners find it difficult with this immense output to fill all the orders which come in from all parts of Eastern Canada and the adjoining States. Time did not permit us to visit the marble quarry two miles distant, but specimens of the rock were shown and much admired. The train was again soon in motion for the run to Black Lake, and in order to lose no more time a lunch, embracing everything that could be desired was served on the way, the fresh air and exercise, and the universal feeling of good fellowship causing everyone to appreciate the good things provided to the fullest extent. Choice bits of scenery abounded, and the run to Black Lake, which was reached at 1.30, was enjoyable in the extreme. Too much cannot be said of the geniality of the hosts of the day, who were untiring in their efforts to make everything thoroughly pleasant, and it is needless to say, judging from the delighted remarks of the visitors, they succeeded admirably. At Black Lake, the party quickly dispersed under the guidance of Mr. R. T. Hopper, one of the principal mine owners at this point, Mr. Frechette, Dr. Reed and others, and were soon scattered about the several asbestos mines which are in close proximity to the railway. The Anglo-Canadian, Frechette, the Scottish-Canadian, and the most remote, the American, lately started by Mr. E. Wertheim, were all visited, the mode of occurrence of the asbestos was pointed out, and a blast fired by electricity at Mr. Hopper's mine brought down a large amount of serpentine and disclosed some excellent veins of the mineral. The methods of mining, cobbing and grading were explained, and the large veins and fine quality of asbestos which show in the cuttings on the face of the hills at an elevation of over 300 feet above the railway were greatly admired. At the American Company's Mines the party examined with great interest the samples of the manufactured product, made at Frankfurt, Germany, including fire-proof wall papers, gaiters, shoes and head pieces for the protection and use of firemen, and those employed in large blast furnaces. Before leaving, Mr. Klein, the courteous manager, presented the ladies with some of these as mementos of their visit to Black Lake. One hour only could be devoted to the various mines in this locality, but the time was thoroughly occupied, and at 3 p. m. the train steamed into Thetford, the headquarters of the industry. Here the largest mines are situated, embracing those of King Bros., the Bell Co., Irving, Johnson & Co., Ross, Ward & Co., A. H. Murphy, and Lucke & Mitchell. The party were here taken in charge by Mr. Thos. Sheridan, the veteran of the industry, and by Mr. Wm. King, whose large-hearted hospitality is so familiar to all who have had the privilege of visiting this area. These gentlemen, assisted by the other managers, afforded every facility in their power to the visitors for the examination of the several mines, explaining the methods of drilling, hoisting, pumping, cobbing, etc., and everyone was delighted with the treatment they received. It is needless to remark that the visitors pronounced their entertainers "jolly good fellows" all round. The peculiar aspect of the asbestos veins, the presence of granulate dykes, the many indications of slips and faults, in these peculiar serpentine rocks, all presented points of great interest, while more than one of the engineers had their attention directed to the advisability or desirability of inventing some simple process by which the great dumps, which in places, contain a large amount of fibre, can be economically worked by machinery for the crushing and extracting of those veins which, in the present state of the industry are regarded as not warranting the labor necessary for cobbing by hand. It is confidently expected that these important problems will before long be solved and the at present unsightly dumps be made a source of profit.

AT SHERBROOKE.

At 5 o'clock a parting cheer was given to Mr. King and their other hosts and the train started on its home run to Sherbrooke, supper being served *en route*, and at 7 o'clock the city was reached in time to dress for the second part of the day's entertainment, that of the Reception in the Art Gallery by the Mayor and citizens of that charming town.

At 9 o'clock the comfortable rooms of the Art Gallery were well filled. The beautiful little museum in connection with the building was greatly admired, and the members of the Institute, together with many of the leading citizens, were formally presented to His Worship Mayor Bryant, who, with light laughter, did the honors of the occasion gracefully and well. Following the reception was the presentation of an address of welcome

from the city to the members of the Institute, which was accepted and responded to in good style by Mr. Platt, of Waterford, N.Y., on behalf of his colleagues. An excellent speech was also made by Dr. R. W. Ells, in which he ably sketched the remarkable growth and prosperity of the mining interests of that section of the Province, and predicted a great future for them. Music and dancing were in order, with light refreshments well served during the evening, and at the close all expressed themselves freely as having passed a delightful day, the remarks of the visitors clearly showing their appreciation of the unbounded hospitality and courtesy of which they had been the recipients, and their recollections of the friends made in Sherbrooke will assuredly be of the most pleasing kind.

THE RICHMOND SLATE QUARRIES.

Wednesday morning broke fair and sunny, the long season of rain having apparently ended. The Pullmans were attached to the eight o'clock a.m. express to Richmond, and after a pleasant run along the beautiful St. Francis, Richmond was reached at 9 o'clock. Here a special engine was attached and the cars run back to the siding of the new Rockland slate quarry, where they were met by the general manager of the works, Mr. Williams, Mr. T. P. Bacon, Secretary to the Company, and by Mr. Taylor, representing the board of directors. A special vestibule train, constructed for the occasion, had been prepared for the excursion over the company's narrow gauge road to the quarry, about five miles distant, which point was soon reached, the beautiful views along the route eliciting many hearty expressions of delight. Arrived at the quarries, which are extensive and have a depth of 200 feet, the visitors were shown over the works, inspecting the various stages of the manufacture of slate such as planing, sawing, splitting, polishing and cutting, the making of roofing slates and the quarrying of the blocks. The material from the quarry is of excellent quality. The magnificent water power, and the admirable arrangements for its transmission by cables to various points was specially commended, as well as the splendid derrick equipment, the only one of its kind in use in Canada. Many of these improvements are due to the inventive genius of the manager, Mr. Williams, who has placed the works on a most satisfactory working basis, and has won the fullest confidence of the owners and directors by the wisdom of his management. A few of the gentlemen went down into the pit, but the ladies did not venture owing to lack of time. Mrs. Williams played the part of a most genial hostess and at 12.30 the warning whistle notified all present that the luncheon prepared for their guests was awaiting their attention. Adjourning to the school house near by, the room was found to be handsomely decorated with bunting, while three tables, covered with such a supply of good things as to fairly astonish us, were tastefully arranged. Mr. Taylor, as director of the company, presided, and was ably supported by Messrs Bacon and Williams. It is needless to say full justice was done to the magnificent collation provided and when the genial host rose to propose the first toast everyone present was in his happiest mood. Among other toasts, in addition to those of the Queen and the President of the United States, were "The American Institute of Mining Engineers," responded to by Messrs. Platt and Sharples; "The Geological Survey," by Drs. Ells and Bell; "The Ladies," by Mr. Ingall and Mr. Low; "The Manager of the Quarries," "The Secretary of the Ottawa Committee, Mr. B. T. A. Bell, etc." After a couple of hours exceedingly well and pleasantly spent, the Special was resumed and the return trip made to the main line of the Grand Trunk. Here the most of the party visited the neighboring quarry of Mr. Bedard, which is being reopened, and from which a very handsome quality of slate is being taken, although the operations are as yet in their early stages. Thence on to Richmond, where connection was made with the Quebec express for Montreal, where a special car had been provided for the trip to Quebec, through the courtesy of Mr. Wainwright, of the Grand Trunk, and attached to the through train to Levis.

AT QUEBEC.

Thursday morning, on reaching Levis, the brilliant sunshine was gilding the magnificent cliffs of the grand old historic city and giving promise of a glorious day, as if determined that the closing portion of the programme should surpass in enjoyment everything that had gone before. Breakfast was speedily disposed of, and the excursionists quickly ascended the heights and spread themselves along the beautiful terrace, admiring the wonderful scenic panorama spread out at their feet—that view which has been justly styled one of the finest in America. The glorious expanse of the St. Lawrence dotted with shipping, the ranges of the Levis cliffs on the opposite shore, with the handsome city along their crest, and in the distance the charming Island of Orleans, all resplendent in the early morning sun, presented a sight new to most and filled all hearts with a lively sense of its magnificence. The scene of the late terrible disaster was examined, after which the dif-

ferent members scattered through the city, some intent on shopping, others on sightseeing, but all instructed carefully to repair sharp at noon to the Champlain wharf, where the thoughtful kindness of Hon. Mr. Mercier had provided the closing act of the generous round of entertainments and receptions that had greeted the travellers at every point. Punctual to the moment the steamer *Orleans*, which had been chartered for the occasion, was reached and a distinguished gathering of Quebec's most prominent citizens, including many ladies, were ready to extend and to carry out to perfection the regal hospitality for which the old historic city has so long been famous.

After the reception, during which the members of the Institute were presented to the Premier of the Province, and to many of the ladies and gentlemen assisting him, the lines were cast off and the sail around the harbor and up the river commenced. A bright cheery day, gorgeously tinted foliage, magnificent scenery on all sides; the noble St. Lawrence was here seen at her best, and the beauty of the sail to Cape Rouge and return was one of the most enjoyable that can be imagined. A splendid collation prepared in Quebec's best style was served, and everything was harmonious to the highest degree. Returning to the city the trip was continued down river to the Falls of Montmorency, which, owing to the heavy recent rains, presented an unusually magnificent appearance. The return was by way of the St. Joseph dry dock, where opportunity was afforded to inspect this superb work, then across to the celebrated Louise docks, and back to the starting point. The distant Laurentian hills were already covered in places with their mantle of snow, and loomed white in the background, but no breath of wintry air served to chill or mar the flood of genuine good fellowship which reigned on board. The return trip was made doubly pleasant by the drinking of several toasts, among which that of the American Institute of Mining Engineers was conspicuous. A suitable reply to the cordial words of welcome expressed by the Hon. Mr. Mercier was made on behalf of the Institute by Messrs. Platt and Sharples, and the singing of the National Anthem with cheers for the Queen and the President of the United States, closed the proceedings for the day. The excursionists returned to the St. Louis, doubtless weary in body and mind, but so charmed with the warmth and kindness of the entertainment, and of the universal display of good fellowship, that all thoughts of fatigue were for the time, at least, entirely forgotten.

A final dinner at the St. Louis closed the round of Quebec hospitality, and at 8 p.m. the greater portion of the party re-embarked on the night express from Levis to Montreal, at which place the members of the excursion finally disbanded for their respective homeward journeys.

It is presumably not too much to say that of the numerous friendships made during the week of the visit of the American Institute of Mining Engineers many will be hearty and lasting. It is pleasant to know that throughout the entire expedition nothing occurred to mar, in the least, the good feeling and the hearty sense of fellowship that prevailed and was conspicuous on all sides. It is certainly not saying too much if we conclude that the few days spent by our distinguished visitors on the trip through the Eastern Townships of Quebec will be productive of great and lasting benefit to the mining industries of Canada. They are all specialists in their several lines of work. They have seen this section of the country with their business eyes wide open. They are quick to discern a good opening for the placing of capital, not only in mining matters direct but in many other enterprises connected therewith. We can only re-echo the wish already so often expressed, that at some not very distant day a much larger representation of our brethren across the line may invade us, with more time at their disposal, that we may show them other stores of mineral wealth—our silver, our gold, our iron, our antimony, our magnificent quarries of building stone, our coal, both of the east and the west, in fact our mineral wealth as a whole—that they may be able to form some faint idea of the greatness of this fair land, "for it is a fair land." And they can safely rest assured that when they do so visit us again they will find that the hospitality they have so lately experienced is no transient thing designed for the occasion, but one of the great elements of the Canadian nationality of which we are all so justly proud.

A Graceful Acknowledgement.

The Secretary of the Ottawa Committee has received the following letter from Dr. Raymond, under date of 24th inst.:—In accordance with a resolution passed at the Ottawa meeting, it is my pleasant duty to request you to express to Sir John A. Macdonald and to Lady Macdonald the cordial thanks of the Institute for the abundant and graceful courtesy, both official and social, with which they received its visiting members and guests, and in recognition of which you are further requested to present to Sir John A. Macdonald a complete bound set of the seventeen volumes of the Transactions of the Institute.

The Sudbury Mines and Works.

(Read by Dr. E. D. Peters, jr., Sudbury.)

The Sudbury ore deposits possess a peculiar interest for a variety of reasons. In the first place they are deep within the borders of the Huronian rocks, and are consequently amongst the oldest deposits that we know of, unless, indeed, the ores were deposited at a much later period than the country rock. Again, they carry nickel in unusual proportions; and lastly, they are unique in containing a small amount of platinum, although arsenic is not present.

I shall not pretend to go into the geology of this region. The Huronian and Laurentian rocks are familiar to all American geologists, and these present only the usual series of gneiss, graywacke, quartzites, greenstones, clay slates, etc., which are characteristic of this gigantic system of rocks which has excited so much discussion of late years.

As in all parts of Canada where it occurs, I believe, the rocks of this system are tilted to an extraordinary degree, and to such an extent that it may be said that the whole country is standing on edge at an angle of something like 70 degrees to the horizon. The general strike of these rocks is south-west and north-east, and as the orebodies follow the lines of stratification, if it can be called stratification, it follows that the course of the latter is the same as that of the rocks, though local twistings and faults are so frequent that no absolute rule can be laid down as to their direction.

But at least one general feature can be stated as universal, I think, and that is that all the orebodies yet discovered in this region are in close proximity to somewhat extensive dikes, or tilted beds, of diorite. It is usually the case that the ore occurs at the point of contact between diorite and the greywacke, although I think in some cases it is found in the midst of the diorite itself. This diorite is of course a volcanic rock, and is composed properly of quartz, feldspar and a considerable proportion of hornblende, but by the predominance of one or the other of these constituents, and the corresponding diminution of the one or more of the remaining minerals, it forms almost every variety of rock imaginable, and differs so greatly in appearance as to deceive any one who has not had an opportunity to observe its modifications.

This diorite forms the gangue rock of our ore deposits to a great extent, and is a rather favourable constituent than otherwise, as its varied bases and comparatively low per cent. of silica makes it far less refractory in the furnace than the quartzose vein matter that so commonly accompanies copper ores.

The ore itself is a mixture of very pure chalcopryite and of magnetic iron pyrites or pyrrhotite, carrying a considerable amount of nickel, this metal no doubt replacing an equivalent amount of iron.

The mines were worked originally for copper, and it was not till a shipment had been sent to be smelted that it was discovered that they were nickel-bearing to an extent that rendered them far more valuable for that metal than for copper.

As the principal amount of work at Sudbury has been done by the Canadian Copper Co., and as I am naturally most familiar with these mines, I shall describe them more particularly, though I believe in so doing I shall be describing the whole district correctly. I know of no mines there that differ materially from the mines of this company, except that most of the later discovered deposits have shown neither the size or the richness of the earlier discovered ones, a fact that is notorious in the history of almost every mining camp that I am familiar with.

It is very difficult to give any correct statements as to either the size or richness of these beds, as they are so variable in the former particular as to make it impossible to give an average figure, while in the latter, it depends upon the class of deposits to which we are referring, as I will explain later.

In order to give some slight idea as to what these mines amount to, I will divide them roughly into two classes. 1st, those which are composed of extremely massive pyrrhotite and are of enormous extent, so large in fact, that we have as yet obtained no idea of their boundaries; and 2nd, those which are more rocky in their nature and less extended in size, but which are very much richer in both copper and nickel. I do not know but that in justice I ought to make a third class, to which one of our most important mines belongs, which is not only about as extensive as the first class, but nearly as rich in valuable metals as the second series. This is a most unusual and pleasing combination, but is certainly attained by the "Evans" mine, belonging to this company, and quite possibly by one or more of their yet undeveloped deposits.

As I trust that many of my hearers may in a day or two visit Sudbury in person, I will briefly describe the main peculiarities of each of these three classes of mines, illustrating them by the three mines which the Company is now working most extensively for ore, and of which, obviously, each belongs to a different class.

As an example of the first class, I will cite the Stobie mine, situated about 4 miles north of Sudbury on a branch of the C.P.R., built expressly for the use of this mine. Before being opened at all, it simply appeared to be an immense rounded hill of red gossan, presenting about as extensive an outcrop, both as to length and width as I ever saw in my life. As to the length, I will only say that although we have opened it but a few hundred feet longitudinally, yet the outcrop shows it to continue in a more or less unbroken condition for some miles over property belonging to the same company. Upon removing this gossan which consists of a brown iron ore in regular stratified layers, (the product of the decomposition of the pyrrhotite,) we come, within 2 to 6 feet of the surface, upon the unaltered pyrrhotite in an almost absolutely massive condition. At intervals, bands of rock of a very limited extent occur, and occasionally considerable masses of diorite, or of mixed ore and rock. But as a rule the ore is absolutely massive pyrrhotite, with occasional pockets of very pure chalcopryite and not infrequently rounded and even angular occluded masses of diorite, from the size of a chestnut up to immense boulders, weighing many tons.

As you will see at the mine, the position of the ground is favorable for opencast work, and we are at present simply taking the whole hill down as we go, on a level with the valley where we start. We have in some places already cut over 100 feet across the ore, thus proving the width to be very great, and also obtaining a fine face for blasting down the ore in great quantities. Our practice here is to bore a series of holes by air drills 8 to 10 in number, and about 10 feet deep, and as far back from the face of the cliff as we think it is safe to go, and then load the holes heavily with dynamite, and fire the whole series at once by a small dynamo, operated by hand, in the usual way.

In this manner we throw down several hundred tons of ore at a single blast, and for two or three days the men are kept busy in blockholing the large fragments and breaking up and loading the ore, preparatory to a fresh blast. Of course there is nothing original about this practice, but it is rather unusual as applied to nickel ore, and we hope to be able to show you one of these large blasts on your proposed visit to Sudbury.

This ore, although lower in both copper and nickel than the ore from the other two mines that we are working, is yet rich enough in both metals to compare with the best Norwegian or German nickel ores, and is especially valuable to us locally on account of its high percentage in iron, which, after roasting to remove the sulphur with which it is combined, makes a most welcome flux for our richer but more rocky ores from the other mines.

Besides cutting across the vein for a considerable distance, as already mentioned, two tunnels have been continued still further across it for some 60 feet, showing massive ore in their entire extent, as well as in their extreme face. We hope, and intend, to extract a large portion of our winter's supply of ore from these two tunnels, which will enable us to work in comfort when the weather out of doors would be too bad.

You will probably notice that our work at present is not economical, the ore being handled mostly in barrows, and being spalled down to size by hand. This is only a temporary make-shift until a new crusher comes to take the place of an old one that was moved elsewhere, when the ore will be handled directly from the face of the quarry by a derrick operated by steam power and conveyed in cars directly to the breaker, where it will be crushed and screened by machinery and delivered automatically into the small cars, which will run directly over the large railway cars and dump the ore into them very cheaply and conveniently. Within a fortnight this will all be in operation, and the hand work entirely discarded.

The second type of deposit is well illustrated by the Canadian Copper Co's "Copper Cliff" mine. This is situated about four miles west of Sudbury, and some six miles south west of the "Stobie" mine in a B line. The ore here consists of the same pyrrhotite and chalcopryite, but by no means so massive nor in such an enormous deposit. There are many places in the Copper Cliff mine where the ore is as massive as is possible, but in other parts, though rich in the valuable metals, it is much intermixed with diorite.

The ore occurs here in irregular masses of several thousand tons each, situated apparently between two cleavage planes in the country rock, so that we can usually find new ore deposits by drifting in the right direction. Although there are absolutely no stringers of ore or veinlets of quartz to connect these ore bodies, the country rock in their vicinity is usually speckled to a greater or less extent with ore; and this is often the only indication we have of our immediate proximity to a large ore body.

At present the Copper Cliff shaft has reached the 500 foot level, on an incline, and the ore at the greatest depth yet discovered retains its full value in nickel and copper. As the pitch of the shaft is somewhat less than that of the ore, the shaft has long since left the vein, and is now

at some distance above the hanging wall of the latter, so that we have to drift some distance to the rear to strike the proper cleavage plane where we may expect the ore. In the fourth level we have struck a fine deposit of ore, while the fifth level is just fairly started. The third level is our active level at present, though we hope before long to have the fourth and fifth levels in even better shape than the third.

The pure sulphide of nickel, Millerite, is found in many mines which contain no nickel in paying quantities, while in our mines it has only occurred once in the Copper Cliff mine. Then it was in very small quantities, and presented its characteristic appearance of fine wires.

MACHINERY.

The Copper Cliff mine is well equipped with machinery, and has as good a plant as need be desired. It has a double skip-road on an incline way to the bottom of the shaft, the skips dumping automatically at the mouth of the breaker in the top of the rockhouse. Here the ore is sledged to a proper size for the 15x9 Blake breaker, which has a capacity of close on to twenty tons an hour, and passes through a revolving screen, where it is sized into three classes suitable for the succeeding operation of heap-roasting. The coarse size will pass a 4 inch ring, the medium size, or ragging, will about pass a 1½ inch ring, while the fines go through a circular hole of ¾ inch diameter. Each of these sizes falls into a separate bin, under which a car runs on proper T rails. Thus the ore is loaded automatically into cars holding 1½ tons, whence it is transported to the upper story of the ore shed, there falling into a series of bins, from which the ore is loaded by means of inclining steel chutes into the railway cars, and goes direct to the roast-heaps.

Aside from the rock-breaker and its engine, this mine has a fine double cylinder hoisting engine with two drums, and a 7-drill air compressor of the Ingersoll Co's make. We do about all of our drilling with Ingersoll drills, using compressed air, and on the whole find them efficient and tolerably economical.

The further equipment of the mine consists of a machine shop just about completed, and containing a 20 ft. lathe, a good sized planer, as well as a drill press and an Acme bolt cutter, so that we expect soon to do all our machine work at home, thus effecting a large saving. These tools are driven by a 10 inch vertical engine, taking its steam from the main boilers in the compressor building. We further have a couple of home-made hydraulic piston jigs, which we are about to use on some of our fine ore that is too rocky, mostly to demonstrate how well this ore will concentrate, as we have very large reserves of ore that is too rocky for smelting, but that should pay a handsome margin for concentrating.

Our laboratory is also situated here, though it will soon be moved to a much more commodious building at the Smelter, where all our samples will be prepared by machinery, and where our electricity for assaying will be furnished by a small dynamo, thus avoiding the annoyance and uncertainty of batteries for that purpose. I need hardly mention that nearly all our copper assaying is done by electricity, but I think it is more unusual to assay nickel in the same manner, but our chemist, Mr. F. L. Sperry, has succeeded in perfecting a method for so doing, which he will no doubt be pleased to show to any who are interested in this matter.

The third class of deposits is represented by the Evans mine, situated about one mile S.S.W. of the Copper Cliff. This mine contains an immense body of pyrrhotite, which is nearly as massive in places as the lower grade Stobie pyrrhotite, while it runs high in nickel. The copper contents is also very satisfactory in many parts of this deposit, and although it is by no means fairly developed, yet I cannot but regard it as an exceedingly valuable property. The company has valued this mine highly from the commencement, and has thought it worth while to provide it with one of the finest shaft and rock-houses in the country. The ore will be hoisted in cars, on a platform hoist, to the top of this high rockhouse, where it is dumped 12 feet on to the breaker floor, which will hold several hundred tons. The breaker jaws are on a level with the floor, and it is fed with great ease, the ore being automatically sieved, as described at Copper Cliff, and the different sizes falling direct into separate bins, whence it flows direct into the railway cars by merely lowering the respective steel chutes.

At present we hoist with a kibble merely, but even this small affair gives us daily some 50 tons of ore. We have here a three drill compressor, and two good pumps, as I regret to say that both the Canadian Copper and this mine make considerable water.

THE ROASTING PROCESS.

The metallurgical treatment of this ore begins at the roast-yard, where the ore is roasted in heaps to remove the major part of the sulphur and oxidize the iron present as far as practicable.

As I trust you may see in person, this roast-yard has been made at much trouble and expense, owing to the

rough and rocky nature of the ground, and the fact that the only proper site for it was heavily wooded. Two railroad tracks of standard gauge stand in connection with it, one being a high trestle-track which extends longitudinally over the entire roastery, the other being situated 4 feet lower than the roaster-yard and extending parallel with the upper track along one edge of the yard. The upper track is to deliver the raw ore from the mines which, as soon as we can make the necessary arrangements, will be brought in dump cars and dumped on to elevated platforms at the side of the track, whence it will be wheeled on to the heaps which extend in a long row at right angles to the tracks. The roastery is nearly half a mile long and 100 feet wide, so that the length of the piles is limited by the width of the ground, which, after allowing space to get around them, and for drains, is about 80 feet. They are about 40 feet wide, and as the ore is piled about seven feet high on the wood, will hold about 800 tons. They are built in the usual manner, about 30 cords of wood being sufficient to kindle a pile. After the main body of the pile is built up of coarse ore, a layer of ragging or medium ore is put on, six inches to a foot thick, according to the supply on hand, and this is covered in the usual manner with fines. By interposing a layer of rotten wood and chips between the ragging and fines we are enabled to roast both of these smaller sizes more perfectly than is usually done, and in general find the whole heap well enough oxidized to take it direct to the smelter without re-roasting any portion of it, which adds materially to the economy of the operation.

A heap of 800 tons will burn about 60 days, if properly managed. Very great care has to be exercised in this operation, or the combustion will be too rapid, and a great part of the sulphides in the ore will melt down into a solid matter, which is most difficult to break up, and which carries far more sulphur than is permissible. As I have stated many times before when writing upon this subject, almost the entire success of the smelting process depends upon a good roast. If the sulphur is not properly removed a great quantity of low grade matter is formed, into which the iron goes, leaving the silica without sufficient flux, and making the furnace run slowly and badly. While, if it is reduced to the normal amount of seven or eight of sulphur in the roasted ore, a rich matte is formed in comparatively small quantity, thus lessening freight and treatment charges, while the iron that was combined with the sulphur is thoroughly oxidized, and thus in a condition to combine at once with the silica, forming exactly the flux required, and making a rapid, clean and fluid run in the furnace. The importance of this process must be my excuse for devoting so much space, but thousands of dollars are lost every year in metallurgical operations for want of attention to this most difficult and delicate process.

The ore is roasted by contract at a very small figure both for fuel and labor, and by a second contract is dug out of the heaps, which are frequently so fritted together as to require light blasts to loosen it up, and wheeled a few yards to the cars which are standing on the lower-level track already described. Thence it is pushed by the engine up a rather heavy grade on to the track which runs over the bins back of the Smelter, which are calculated to hold nearly a week's supply. At this point, we begin the description of

THE SMELTING OPERATION PROPER.

I think the first thing that will strike most furnacemen on seeing the Canadian Copper Co.'s furnaces is the small size of the building covering them. There are 2 smelting furnaces and 2 buildings, but as they are practically duplicates of each other, it will suffice to describe one. The entire building is 40x65 feet, of which 40x35 is on a lower level, and contains the furnace, while the rest of the floor is 8½ feet higher, and is devoted to the ore and fuel bins. When you consider that the furnace averages 125 tons per 24 hours on favorable ores, I think that the space it takes up is unusually small, though amply large for all requirements. The furnace itself is a steel water-jacket of the Herreshoff patent made by the Jenckes Manufacturing Co. of Sherbrooke, P.Q. It is rectangular with rounded corners, and a slight convexity all round, so that it really approaches an oval. Its section at the tuyeres is 3 feet 3x6 feet 6, and it has 11 2½ inch tuyeres, there being 5 on each side, and 1 at one end, the discharge opening being at the other end. It is 6 feet high from tuyeres to charge-door, and is an unbroken water-jacket, the entire distance from the cast bottom-plate to the charging-door. Above the threshold of this opening, is a housing of boiler iron, lined with fire-brick, which lasts as long as the furnace does. The charge-door is situated at one long side of the furnace, while the flue opening is opposite to it, the entire flue as well as the iron charging platform resting on a series of girders and 1 beam, which are supported by the stone walls of the building and by 3 iron columns which are located so close against the furnace as to be entirely out of the way. The red brick flue enters into a series of zigzag dust chambers outside of the building which are connected with a stack of the same material, 60 feet

high, and 5 feet square inside from bottom to top, its diminution in size, due to the taper of its walls, being fully compensated by the increasing thinness of its walls in height, they being only 8 inches thick for the top 20 feet. All the brick work is securely ironed, so thoroughly that though in operation for nearly 9 months, no crack of any moment has shown itself, and it promises to last indefinitely. This is due to extreme care in preparing the foundations in this frosty climate, and to proper ironing.

The water space in this furnace is only 2 inches wide instead of 6 or 8 as is often the case, and we experience no trouble in consequence. The chief peculiar feature of this furnace is its front connecting reservoirs, or "well," as we term it. It is a circular, cast-iron, water-jacketed vessel, mounted on 4 stout wheels, and so designed that its hole in one side connects directly with the outlet hole of the furnace. This forms a connecting channel a few inches in length thoroughly protected by water-cooling, through which the molten slag and matte flow out of the furnace as rapidly as they are formed. They thus escape the influence of the blast, and any possibility of the great bugbear of copper-smelters, the formation of great masses of cast-iron, metallic iron, called "sows" or "salamanders," is completely avoided, thus robbing smelting of half its terrors. Many of the new varieties of furnaces have some similar provision, but none so convenient and perfect as this, I think.

The slag and metal separate very perfectly in this quiet, spacious reservoir, and the slag flows in a continuous stream over the jacketed lip of the same at a height of some ten inches above the outlet hole of the furnace. This ingenious arrangement completely traps the blast, and owing to it, we never have any foul slag to re-smelt from one week's end to the other. The matte is tapped at intervals of 10 to 20 minutes through a separate bronze, water-cooled taphole-casting, which is bolted to one side of the well, and which is plugged with clay in the usual manner. Owing to its proximity to the hot stream of molten matter from the furnace, the taphole never chills, and instead of the ordinary sledging and labor every time the operation of tapping takes place, with us the furnace-man uses simply a half inch steel bar, which he drives through the clay plug with a few light taps of a carpenter's hammer, the matte flows quietly into a slag pot placed for the purpose, and the small taphole in the casting is closed without any chance of failure by a clay plug, as usual. There is no interruption of the blast, and none of the ordinary excitement and confusion so generally attendant on the operation of tapping. A slight matter, but one worth mentioning, is an arrangement that we have for the better preservation of the cast-iron plates that form the floor of the building around the furnace, and which it is particularly essential to have very smooth and solid, so as to easily draw heavy pots of molten material over them without spilling it. Usually whenever a potful of slag is drawn away from the furnace, and before a new pot can be run in in place of the old one, a considerable amount of slag drops upon the iron plates, which in spite of more or less protection from sand, soon become so warped and out of shape, that within three or four weeks they are totally destroyed, and have to be replaced by new ones, at a considerable expense of time and money. To obviate this universal difficulty, we have cut a circle in the plate just where the stream of slag naturally falls, and have introduced into this a shallow cast-iron basin. The slag drips into this without injuring the plates, and is taken out from time to time by the fork and thrown into the slag pot. The basin stands two months or more before it is destroyed, and is replaced at a cost of 75 cents, and without a moment's loss of time to the furnace.

There is nothing particularly worthy of notice about the charging-floor, except what I have already described. Every pound of ore and fuel is accurately weighed on a 5-beam charging-scale, and is also sampled. In the same way, the matte produced is daily sampled, as well as accurately weighed, before it is dumped from the pot, and the slag is sampled from every potful and assayed once every 24 hours. From these data, we are able to prepare an accurate daily history of the furnace work in each furnace for the benefit of the Directors at home, to whom it is sent in a weekly sheet.

By properly mixing our three different ores, we are enabled to get along without ever using a pound of flux, which is a very fortunate circumstance, as I know of neither limestone or iron ore in the vicinity, that would be suitable for this purpose.

For fuel, we use Penn coke of the best quality, which is brought here via the Great Lakes and the Algoma branch of the C.P.R. at a less cost than might be imagined. We smelt seven to eight tons of ore to one ton of coke, as proved by having our coke overrun when we clean up and estimate our large shipments of some thousands of tons, for there is very apt to be a heavy deficit in coke.

Our furnaces are supplied by wind with two separate No. 6 Baker blowers, one to each furnace. The blower to our No. 2 furnace is provided with a vertical engine which forms a part of the blower itself, while our No. 1 furnace is run by a large Brown automatic engine which

has ample power for other additional work. Our water is pumped from a neighboring stream where we have built a dam and formed a small lake by two duplex Worthington pumps, either of which has ample capacity to supply both furnaces. Two steel tubular boilers, set in one battery, supply steam for the entire plant.

NOTABLE FEATURES OF THE WORKS.

If I were asked to point out the most notable features of these works, apart from the mines, I should mention first the very large capacity of the furnaces, nearly or quite 125 tons per 24 hours for each on fair ores; also the entire absence of flux, owing to a more or less basic gangue rock, and some very massive pyrrhotite from one of our mines, the Stobie; also the very favorable ratio of ore to coke, 6 or 8 to 1, not as the result of an especial trial under favorable circumstances, but from months of average work. The same may be said of the capacity of the furnaces, which is greater than any that I know of running on pyritic ores.

Of course, the chief peculiarity of our product is the large percentage of nickel which our matte contains in addition to its copper contents. Our average matte will be about 27 per cent. copper and 15 per cent. nickel, and both of these metals are of such a purity that when separated they are fitted for the most delicate work, and will stand any tests that any similar metals stand. As every copper smelter knows, we can determine the percentage of copper matte by eye with such exactness that from any percentage between 25 and 80 I have never cared for an assay of it for my own benefit, as my eye will always tell me its copper contents near enough for metallurgical or chemical purposes. But even a very slight admixture of nickel completely masks the color and texture produced by varying percentages of copper, and in our matte I do not think that any one could distinguish between a matte carrying 15 and one carrying 40 per cent of copper, providing that nickel were also present in our usual proportions.

At present we break our matte into large pieces, which we pack into old oil barrels, chinking up the interstices with the smaller fragments. These are shipped to Swansea, or to various German works, according to the bids of the foreign refiners for our product.

It may perhaps be news to some of my hearers to learn that the entire world's production of nickel annually is less than 1,000 tons, the bulk of this being produced by the New Caledonian nickel mines, which are oxide deposits situated in a serpentine dyke. While I am not at liberty to give figures of our production, it will still be very evident to any observer that the world's production of this year will be a good deal larger than that of 1888, and as we are told that New Caledonia is losing money at the present low price of the metal, it is evident that we need not look far for the world's supply. The Gap mine, owned by Mr. Wharton, of Philadelphia, has been for many years the one nickel producing locality of the United States, but is practically out of the running at present prices. Therefore the United States, by its present heavy duty on nickel, is taxing its entire population without its being of the slightest benefit to anyone except a few foreign producers, while it drives away everyone who may desire to establish works for the refining of this metal within its borders, and thus loses a most remunerative industry that would employ great numbers of men and great quantities of material, without obtaining the slightest benefit in return.

DISCUSSION.

THE CHAIRMAN (Prof. Eglestone)—You need have no trouble about your nickel, because just as soon as you make it cheap enough it will be used in every kitchen in the world.

MR. THOS. MACFARLANE—I have no remarks to make by way of criticising this paper, but I do not think we should allow the opportunity to pass without congratulating Dr. Peters on having presented a paper so full of information on the subject of the description of the improvements made in the metallurgy of nickel in a comparatively short period. As he was reading his paper I compared his various improvements and method of treating the ore with what I saw in operation something like thirty years ago at the Reminger nickel works in Norway. I think Dr. Peters will know the locality I refer to.

DR. PETERS—Yes.

MR. MACFARLANE—The improvement in the treatment of the ore is simply enormous compared with the old method of working. I do not see any difficulty at all in this whole matter except disposing of the nickel; but I suppose that will have to take care of itself. I simply rise to express my extreme gratification at having listened to such an interesting paper.

DR. ASHBURNER—I have nothing to say with regard to the metallurgical or geological features of Dr.

Peters' paper, but I have had occasion during the past years to look into some matters in which I think my friend Dr. Peters could help me out. Some three months ago I had the pleasure of visiting Sudbury and of being his guest for several days, and examined with a great deal of interest and instruction the works under his charge. Having received a telegraphic call I regret that I shall not be able to visit Sudbury again with the members of the Institute, as the trip will be of the greatest interest to every one. The geological association of the ores is not only interesting, but the ores themselves are unique. To mineralogists it is of consummate interest, and for geologists the way it occurs in the Huronian rocks is of great interest. As far as the arrangement of Dr. Peters' plant is concerned, I regret that Dr. Peters has not had such a plant erected on the other side of the border, because it is so complete and unique in its way that it seems almost a misfortune that American engineers should have to come to Canada to see something which they cannot see on their own side of the line. The furnaces themselves are particularly interesting in the handling of the sulphide ores which Dr. Peters has been handling there, and remarkable in the quantity of ores which they reduced. We all know the remarkable experience which our recently elected member, James Douglas, although an old friend of many of us, has had in the Copper Queen mine in Arizona, where he has reduced 150 tons of ore in one day in a furnace very much the same size as the largest furnace of Dr. Peters; but the ores are quite different, being largely oxide and carbonate ores and having less than five per cent. in bulk of sulphides; so that while we have been regarding the practice which Jas. Douglas has accomplished in handling the Copper Queen ores, it is really something phenomenal to think of the sulphide ores which Dr. Peters has handled in the furnace at Sudbury. Everyone here who is interested in the matter, either as geologist, mineralogist, mining engineer, or metallurgist, will be amply repaid by a trip to Dr. Peters' works.

DR. PETERS—I forgot to mention Dr. Bell's kind offer to exhibit for the benefit of the Institute some of the Sudbury ores which he has here. One thing I might state which might be useful metallurgically. I have not mentioned the reason why we obtained such a large result from such a comparatively small furnace. I am making some tests now with steel plates which, if they are successful, will enable me to put up a 200 ton furnace to work somewhat cheaper than our present furnace. I know no reason why we cannot smelt 500 tons a day just as well as the amount we now handle. It is all a question of handling. They have conquered all these things in your furnaces, and we feel sure we will have a 500 ton furnace in operation if the steel plates will stand it. The secret of our rapid smelting is not that there is anything remarkable in our ores. It is that we use a very powerful blast, and more than anything that our different ores are most carefully mixed together before they are smelted. Of course we pay great attention to the analysis—to weighing out the exact amounts of ore—to feeding the furnace and other minutiae, but in addition to that, I spoke of two things of importance. One is the blast and the other is the percentage in the heaps. It makes all the difference in the world how the materials are to form that percentage. We find the greatest benefits result from mixing ores of three kinds and roasting them in heaps together. In that way they get so well mixed that every atom of silica has its necessary atoms of lime and iron united with it, and it does not have to run all over the furnace to get its atoms. That is not the scientific way, but it is better that way than if we mixed these ores with a shovel. It has been observed that it makes the ores flux better to mix them—to the extent of ten per cent, if not more.

DR. BELL—As I have been engaged by the Geological Survey of Canada in and around Sudbury for the past two years, and had passed through the district many years before the discovery of copper, I may say that I have listened with a very great deal of pleasure to Dr. Peters' paper. I can bear testimony to the very excellent work he is doing—the perfect working of the furnace and everything in connection with the copper company's mines there. We Canadians may well congratulate ourselves upon the good work Dr. Peters is doing there. I know he has encountered no ordinary difficulties—difficulties which might have been obviated had the authorities co-operated with him and encouraged this industry as they might have done. Dr. Peters has been subjected to criticism by persons who knew not of what they were speaking, but he has gone on and achieved a success which is unexampled in the history of metallurgy and mining in this country. I have no doubt that the company will go on and readily find a market for all the nickel they produce. One reason why it is not more largely used now is on account of the high price. The geological relations of these deposits has been one of my studies, but there is a puzzling question which I had hoped Dr. Peters would have answered, viz., "How came the copper there?" If he had explained to us the

history of the formation of these deposits I should have been very glad.

DR. PETERS—It is your province to say that.

D. RAYMOND—Dr. Peters' business is to get at it. Who put it in as another question.

DR. BELL—It is a puzzling question, and one which geologists, mineralogists and chemists cannot even answer. Dr. Peters is an experienced man, and possibly he might tell us something of the behavior of copper under high temperatures. If he has any theories I should like to hear them.

DR. PETERS—I have none.

DR. RAYMOND—I only desire to add a word or two to what has been said to express my adhesion to the praises of our friend's work. It is a good many years now—more than twenty years—since I first met Dr. Peters, struggling with greater difficulties than seems to be his perennial lot to-day, in South Park, Colorado. We lost sight of him for a while, but he has now, as the practical manager of these works at Sudbury, and as the author of our best book on the metallurgy of copper planted himself so prominently in our profession that we hope he will never get out of it. With regard to this matter I had made a note to express my own desire that if Dr. Peters had—well you know what in Dickens' novel, "Great Expectations," what Gargery says to Pip, "Wasn't there a dog Pip? Not a small dog? Nor a pup?"

Now if Dr. Peters had only a small hypothesis, or a "pup" that would become a hypothesis, that would throw any light on this paragenesis of sulphide copper ore or other minerals which surround it, we should be glad to know of it. Dr. Bell and I had a talk at the Geological Museum this morning on this subject in the presence of specimens from the old Acton mine. Allusion has been made to the presence of organic matter, indicated sometimes by bituminous rocks and sometimes by fossils, and I suppose in the gangue of reduced ores, in which class I might include native ores of sulphides. Native ores might have been reduced from oxides, and sulphides from sulphates. In the days when I was lecturing, as a desperate resort I have been accustomed to say when inquisitive students would attempt to corner me with importunate questions, that where we could find traces of bitumen we had reason to assume the presence of organic matter, and fossils the same, but where we did not find any we could assume that they had not been there. In that way I got out of it. I can say honestly, since we have grown up and have no class present I do not mind confessing it, I cannot say that I am altogether satisfied with my theory on that point. I think the whole subject of the diffusion of sulphides in places where the reducing agent is not present or indicated is not easily to be conceived—is one that is a mystery in the good old fashioned sense of a mystery. That is a thing not yet found out. When it is found out it may be simple enough. It is not necessary that the clue should be everywhere present. When we find clear proof of such a genesis we shall be able to infer it and apply it to some other place. In the Jersey iron mines the distribution of our ores is pretty much in the same position and shape of those at Sudbury—that is in chutes or pods, sometimes in echelons, as they seem to be enclosed in siliceous crystalline schists, and clad as if they had been at first set up with these crystals around them. In the mines which I am managing at present for Cooper, Hewitt & Co., we have not a single case where any fault can be traced. The recrystallization of the rock had obliterated all traces of the "fault" anywhere from ten to thirty feet, and as it did not bring in another kind of rock we passed from one to the other, and not being close observers we got from gneiss to gneiss and did not realize that we had passed any "fault" at all, but finding ourselves out of the deposit we cross-cut in the direction as indicated and found another. If we had only a single case of copper ores in such condition as the Sudbury mines present, or the old Acton mines present, I think we might, in default of a better explanation, hold up our heads with courage to the young aspirant and fire off an explanation. But when these sulphides are deposited in now bituminous, now fossiliferous limestone, as in the copper of the Ducktown range, associated as they are say with pyrrhotite and also a small percentage of nickel, we have got an adequate explanation of their genesis. I want to ask whether Dr. Peters attaches any significance to the presence of nickel universally, although in small proportion, in all that pyrrhotite group of mines extending from Litchfield, Conn., way down the Alleghanies to Ducktown—the whole range—limonite at the top, then concentrated copper ores lodged down to the water line. The persistence of the line makes it a geological horizon; but so far as I know no special light has been thrown on the genesis of it. I would also like to ask another question and that is whether anything particular has been done in the

relation of alloys of phosphorus and nickel in developing metals of extraordinary strength and elasticity. Dr. Peters' paper gives us an idea of the process that has been going on during the past ten years in all American metallurgy, and has placed it at the head of the metallurgy of the world to-day. It is the process of sweeping away a thousand details and cobwebs which we supposed up to a few years ago to constitute the science of metallurgy. Distinctions and infinite comparisons beyond compare. But what could we do? In iron? We put wrought iron hoops around our furnace—got a good strong engine and blew. We have forgotten now how we crushed the ore, and a great many things we supposed to be symptoms. We are all now valetudinarians. We simply watch our furnaces and the symptoms take care of themselves. Ten years ago, I stood up at a meeting of the Institute and told those assembled that I had had more experience and knew more about taking care of a blast furnace in difficulty than in taking care of one which was running well. We went through indescribable troubles and difficulties and agonies with our Durham blast furnace. She was built for 400 tons a week, and we struggled along and were proud of an average of 250. We ran down to 50 tons, and to nothing sometimes, and we scaffolded and performed surgery upon her, and all the forms of injection, the blowpipe, dynamite and everything that anybody could do, and we had all the trouble there was to be had. Now, last week we were making 850 tons out of that furnace with very close to a ton of fuel to a ton of iron. For a long period our record of fuel had been surpassed by our neighbors, the Glenoid people, but our record has not been surpassed of late. I say that not on my own authority, but on that of Sir Lowthian Bell, when our figures for a long time had been submitted to him. As soon as we got into that way of blowing very hard and working fast, keeping her feet warm and her head cool, all the internal dissensions disappeared. A great many things that used to trouble us to death if we were working along in the old fashioned way have disappeared. Main strength has been the secret of success in modern blast furnaces. We borrowed from our friends of the lead smelting industry the water jacket hearth. We are practically blowing with a certain sort of superstition in the encouragement of fire brick manufacture, for we still put fire brick there, but we have a water cooled hearth, and good hooping that holds every thing in. Our furnaces stand 15, 16 and 20 lbs. to the inch and we make things melt. What else can they do? (Laughter). With regard to the boon in water jacket furnaces, which our brethren in the lead industry have bestowed on us, we have returned it by the example of Mr. Herreshoff. He has come to use main strength as Dr. Peters has. What he has come to do in copper was done in the metallurgy of lead when they took hold of that business and restored to life the old idea of beginning to make large furnaces and smelting large amounts of ore. In the early days when there were some thirty furnaces running, we would get up in the morning and count how many were bugged up that day. When the salamander was acting it was sending off an awful lot of fumes, and by the volume of these fumes which were staining the sky we could see how many were shut down. It was a regular thing to have a salamander every eight days. They would hitch oxen to the old salamander and drag it out, until I have seen half acres covered with them, then I have known the managers to dig under them and bury them, and in days to come geologists may dig there and find curious nodules. (Laughter). There will be wrought iron found in curious deposits. In the metallurgy of the future we are going to apply energy, and we are going to get more energy by the combustion of fuel, in transmission by electric conductors, and in all ways to overcome difficulty by force. We are going to stop fooling with nature and just charge, attack, and she will give up. (Hear, hear). Put on the force and she will give up. One word further. Dr. Peters has revealed accidentally what is the secret of metallurgy and what will prevent our friends the chemists from having the control. Mr. Macfarlane looks glum; but the chemists are not going to be left out. That is the study of the slag as the true guide for the metallurgist. It doesn't lie. That is the study of the slag and increased facilities for its analysis. By practice and skill we shall be able to train our foremen to recognize the physical signs of the slag. I remember some years ago Mr. Macfarlane suggested a rapid method of determining the density. It is not always necessary to do that. There is a science not written in books, and not known to many outside of the locality where it was born; but in every place every metallurgical director who is worthy of his place and rises to the full capacity of his skill, will train himself and his foreman to read the melted surface of the slag. (Hear, hear). He will know what it is when he looks at it. Then there will be the necessity for the chemist to verify this rapid observation. I think it is being based on copper by the book of Dr. Peters. (Applause). I am proud to think that other books such as those by Mr. Staderfeldt took rise in papers read before this Institute, while many other works springing out of our

transactions are enriching the technical literature of the world, giving us a little to life and earning for us the gratitude of mankind.

DR. PETERS—I dislike to take up your time, but it would be discourteous not to reply to a few of the questions which Dr. Raymond has asked me. I am however, overwhelmed with the praise of my professional brothers. I came here ashamed of my paper because I know it is not a good one. I sat down to the typewriter and did not have an opportunity to read it over afterwards. The reason for this is because I have so much work to do, and under the circumstances I must thank you for the indulgence you have given me. In regard to this conundrum as to whether I attach any significance to the occurrence of nickel in pyrrhotite in this long range running north and south, I do not. There is a little bed in the Ely mine, but whether I have found all the pyrrhotites to have copper, I say no, I have not. I have been aware of the fact that there have been such breaks. There are such breaks in the Ely mine, where there is hardly a trace of copper, and in others where there were cobalt and platinum.

PROF. EGLESTON—You have not spoken of Sperrilite?

DR. PETERS—The platinum in our mines does not occur in the form of Sperrilite. It is Arsenite. I do not know of any other pyrrhotites containing one and a half per cent of nickel except those of Mr. Horton.

PROF. EGLESTON—It is three-quarters of one per cent.

DR. PETERS—I put it at a half per cent.

DR. ASHBURNER—The ores of the Pennsylvania mines certainly run less than one per cent.

MR. MACFARLANE—I think the Cap mines have had one and a half per cent. of nickel.

DR. PETERS—I speak of the Cap mine by itself. I can speak, however, of what no one seems to have noticed, I refer to this extraordinary fact that pyrrhotite occurs in one place and pyrite in another without any apparent reason. If that fact were answered it would give us the methods of deposition.

MR. MACFARLANE—Pyrite frequently contains cobalt.

DR. PETERS—Yes; but pyrrhotite does not.
(To be Continued.)

British Columbia's Coal Fields.

"The Comox and Nanaimo coal fields are the most important in the province, and the latter is that from which almost all the coal so far raised has been obtained. The cretaceous rocks constituting these coal fields border the southwestern side of the Strait of Georgia, forming a belt of comparatively low rolling or hilly country between the mountainous region of the interior of Vancouver Island and the coast. The quality of the Comox coals is equal, if not somewhat superior, to that of those of Nanaimo. They contain but a small percentage of water and the ash is also very low. Several of them yield strong cokes. The area of the Nanaimo coal field is estimated at about 200 square miles. There are at least two distinct seams of workable thickness in this area, but in consequence

of folds and faults it is not easy to fix the equivalency of beds in its various parts. Three collieries are at present in operation here, the Nanaimo, Wellington and East Wellington. The works of the two first named are on a very extensive scale, embracing numerous shafts and inclines, provided with good machinery, railways and wharves. In the Vancouver Colliery the principal workings are upon a seam which averages from 6 to 10 feet in thickness. A second seam, overlaying the last and separated from it by 140 feet of sandstone, is 7 feet thick. The seam worked in the Wellington Colliery averages about 9 feet in thickness, and yields a rather dry steam coal which does not afford a strong coke. The coal from the Vancouver Colliery, on the contrary, gives a good coke and produces a large quantity of illuminating gas."

In 1850 a chalk cliff about 200 feet high, near Seaford, on the coast of Sussex, was thrown down by the explosion of 24,000 pounds of powder, and 292,000 tons of rock were dislodged.

At Holyhead, in 1850, a hard quartzose schist cliff was thrown down by 12,000 pounds of gunpowder. About 40,000 tons of rock were dislodged, which was used for the harbor works at that point. In January, 1867, another blast was fired at the same place, in which 16,000 pounds of powder dislodged 120,000 tons of rock.

SPECIALIST IN MICA MINER'S AGENT

RICHARD BAKER,
6 & 7 Cross Lane, - London, Eng.

WANTED.

A POSITION as SUPERINTENDENT in Coal Mines either in the States or Canada. Has had over twenty years experience as Superintendent in England and America and holds a British Government Certificate. Highest testimonials.

Address "SUPERINTENDENT"

Care of the Canadian Mining Review,
Ottawa, Ont.

THE DOMINION WIRE ROPE CO.

MANUFACTURERS OF



Works at LACHINE.

For Hoisting, Mining, Transmission of Power, Towing
Ship Rigging, Guys, etc.,

ALSO

Lang's Patent Wire Rope for Transmission and Colliery Purposes.

JAMES COOPER, Agent, Montreal.



MONEY ORDERS.

MONEY ORDERS may be obtained at any Money Order Office in Canada, payable in the Dominion; also in the United States, the United Kingdom, France, Germany, Italy, Belgium, Switzerland, Sweden, Norway, Denmark, the Netherlands, India, the Australian Colonies, and other countries and British Colonies generally.

On Money Orders payable within Canada the commission is as follows:

If not exceeding \$4.....	2c.
Over \$4, not exceeding \$10.....	5c.
" 10, " " " 20.....	10c.
" 20, " " " 40.....	20c.
" 40, " " " 60.....	30c.
" 60, " " " 80.....	40c.
" 80, " " " 100.....	50c.

On Money Orders payable abroad the commission is:

If not exceeding \$10.....	10c.
Over \$10, not exceeding \$20.....	20c.
" 20, " " " 30.....	30c.
" 30, " " " 40.....	40c.
" 40, " " " 50.....	50c.

For further information see OFFICIAL POSTAL GUIDE.

Post Office Department, Ottawa.
15th Sept., 1888.

LEDOUX & COMPANY,

10 CEDAR ST, NEW YORK,

Engineers, Metallurgists &
Assayers.

Public Ore Sampling & Storage Works

All the principal buyers of furnace materials in the world purchase and pay cash against our certificates of assay, through New York banks.

By special permission of the Secretary of the Treasury of the United States, cars of ore or copper matte passing through in bond can be opened and sampled at our works.

Consignments received and sold to highest bidder. Send for circular giving full particulars.

Mines examined and sampled. Assays and
Analyses of all kinds.

MINERS OF NOVA SCOTIA!

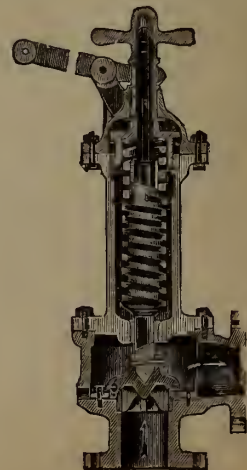
W. & A. MOIR,

MECHANICAL

Engineers and Machinists,
HALIFAX.

Manufacturers of

Mill and Mining Machinery,
Air and Circulating Pumps,
Hand and Power Elevators,
Marine & Stationery Engines,
And Brass and Iron Castings
of every description.



CRUDE AND MANUFACTURED FOR ALL PURPOSES.



Cloths, Facings, Furnace Cements, Paper, Stove Linings, &c.

SPECIALTIES: FIRE- FELT, a flexible Asbestos Sheet, made in tubular sections and rolls, best and most durable non-conductor made.
SUPERATOR, a strong fire & waterproof fabric for sheathing & roofing buildings, fire proofing boiler rooms, &c.

THE CHALMERS-SPENCE CO.,

419 TO 425 EIGHTH ST., NEW YORK

ASBESTOS.

RUSSELL & CO.

PROVINCIAL AND DOMINION

LAND SURVEYORS,

CIVIL AND MINING ENGINEERS,
PORT ARTHUR, ONTARIO.

Mining Properties Surveyed, Reported on and Dealt in

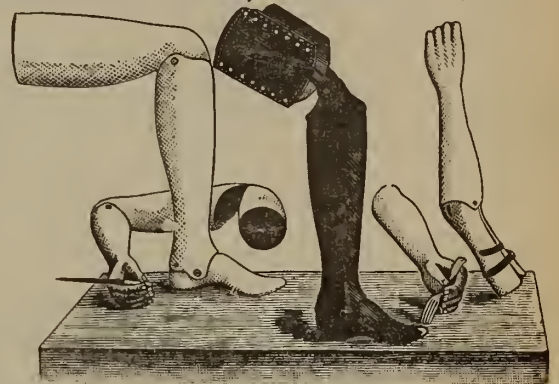
Latest and Most Complete Plans of Thunder Bay
Mining District Always on Hand.

A. L. RUSSELL, A. H. MACDOUGLL, W. W. RUSSELL
P. L. S., D. L. S. P. L. S., D. L. S. M.E.A.MCAN.SOC.C.E

PROPERTIES FOR SALE.

Parties having developed or undeveloped mineral lands for sale will find the REVIEW an admirable medium for bringing them before the notice of CAPITALISTS and INVESTORS in GREAT BRITAIN and the UNITED STATES.

BEACOCK & CO., - - BROCKVILLE, ONT.



—Manufacturers of—
Rawhide, Artificial Limbs & Splints
Patented in the United States and Canada. Send for prices.

Gold Mining Machinery.



I. MATHESON & CO.,

Engineers and Boilermakers,

NEW GLASGOW, N.S.

TAURO FOUNDRY AND MACHINE CO.

TRURO, N.S.

Engineers & Founders



OUR SPECIALTIES

— ARE —

Gold Mining Machinery

Of every kind, with latest Western Improvements.

ROTARY SAW MILLS

In Latest Styles.

ALSO MANUFACTURERS OF
BOILERS & ENGINES

Iron, Bridges, Stoves,
SHIP, MILL and GENERAL
CASTINGS.

G. CLISH,
Manager.

D. McDONALD,
Suft.

S. R. TUPPER,
Sec'y and Treas

WM. STAIRS, SON & MORROW,

174 to 190 Lower Water St., Halifax, N.S.,

Importers and Dealers in all kinds of Mining Supplies, Steel Wire Ropes,

LUBRICATING OILS, EXPLOSIVES, &c. &c.

Correspondence solicited. Goods promptly supplied. Sole agent for Canada for Patent Mineral Fusible Cement.



PROVINCE OF NOVA SCOTIA.

Leases for Mines of Gold, Silver, Coal, Iron, Copper, Lead, Tin

— AND —

PRECIOUS STONES.

Titles given direct from the Crown, Royalties & Rentals moderate

GOLD AND SILVER.

Under the provisions of chap. 7, Revised Statutes, of Mines and Minerals Licenses are issued for prospecting Gold and Silver for a term of six months, which can be extended by renewal for another six months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. Up to five areas the cost is 50 cents per area, for every area in addition 25 cents. Cost of renewal one half the original fees. Leases of any number of areas are granted for a term of 21 years. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents annually for each area contained in the lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at \$19.00 an ounce, and in smelted Gold valued at \$18.00 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province he may stake out the boundaries of the area he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for twelve months are issued, at a cost of twenty dollars, for Minerals other than Gold and Silver, out of which one square mile can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department free of charge, and provision is made for lessees and licensees whereby they can acquire promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties makes the royalties a first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists who have always stated that the Mining Laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are :—Copper, four cents on every unit ; Lead, two cents upon every unit ; Iron, five cents on every ton ; Tin and Precious Stones, five per cent. ; Coal, 7½ cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

THE HON. C. E. CHURCH,

Commissioner Public Works and Mines,

HALIFAX,

NOVA SCOTIA.

VALUABLE PLUMBAGO

AND OTHER

Mineral Lands FOR SALE,

IN THE TOWNSHIP OF BUCK-
INGHAM, COUNTY OF
OTTAWA.

1st.—Lot 28, in the 6th range, containing 100 acres, in addition to the salina of the lake.

2nd.—North half of lot 23, in the 5th range, containing 100 acres.

3rd.—Nine acres of lot No. 28, in the 5th range, with water privileges thereto appertaining, being site of mill dam, etc., etc.

The property formerly belonged to the Montreal Plumbago Mining Company, and was worked successfully for several years, until the company's mill was destroyed by fire, but the mill dam remains almost uninjured, and there are on the property several houses, sheds, etc., built for various purposes when mining operations were carried out.

The Plumbago Deposits

upon the property are regarded as amongst the richest and most extensive in the Dominion. As to the quality of the Plumbago, it has been extensively used in the manufacture of crucibles, lubricating leads, stove polish, etc., etc., and given unbounded satisfaction. This is established by the experience of consumers, and by a certificate from the celebrated Battersea Crucible Works, London, England, a copy of which is open for inspection.

MICA

has also been discovered in quantity

The lands are in the Phosphate region, and recent prospecting has disclosed a rich and extensive deposit of this mineral. There are unrivalled facilities for transporting the ore to and from the mines by the Ottawa River and C. P. Railway. Distance from mines to Railway Station 6 miles. Good road.

All that is required to make these valuable mines handsomely remunerative is a little capital and enterprise.

The Title is Indisputable.

For information apply to

WM. H. DICKSON,
160 Waller St., Ottawa.

H. E. DICKSON,
Russell House, Ottawa.

OR TO THE OFFICE OF

THE CANADIAN MINING REVIEW.
OTTAWA.

SHIPMAN ENGINES, ACME MODEL. COAL OIL FOR FUEL.



To parties requiring a safe, reliable, durable and economical Steam Launch, from 20x4 to 35x7 with ample power to give satisfactory speed can supply the best on the market and at prices which will defy competition for a like quality of goods. We have a full staff of competent boat and engine builders and guarantee every article to be strictly first class. Hundreds of our engines from 1 to 12 h. p. Marine or Stationary have been in use for years and are acknowledged superior to all others. No smoke, dirt or sparks, no manual or mechanical labor necessary. You have the privacy of your launch for your family. As the water and oil supply is automatic very little attention is required. But a few minutes is necessary to get up 100 lbs. of steam; when you return to the boat house by turning a hand wheel all fire is extinguished. Orders for coming season should be placed at once, as the demand is much in excess of previous years. Write for 1889 circulars giving prices, testimonials, etc. No attention paid to postal cards.

JOHN GILLIES & CO., Carleton Place, Ont.



FOR—

Mines, Elevators, Inclines, &c.

GALVANIZED GUY ROPE. BRIDGE CABLES.
HAWSER ROPES.

WIRE of all kinds. Insulated WIRES

John A. Roebling's Sons Co.

117 & 119 LIBERTY St., NEW YORK.

H. L SHIPPY Sec'y.

PHOSPHATES, PHOSPHATIC MANURES, AGRICULTURAL FERTILIZERS

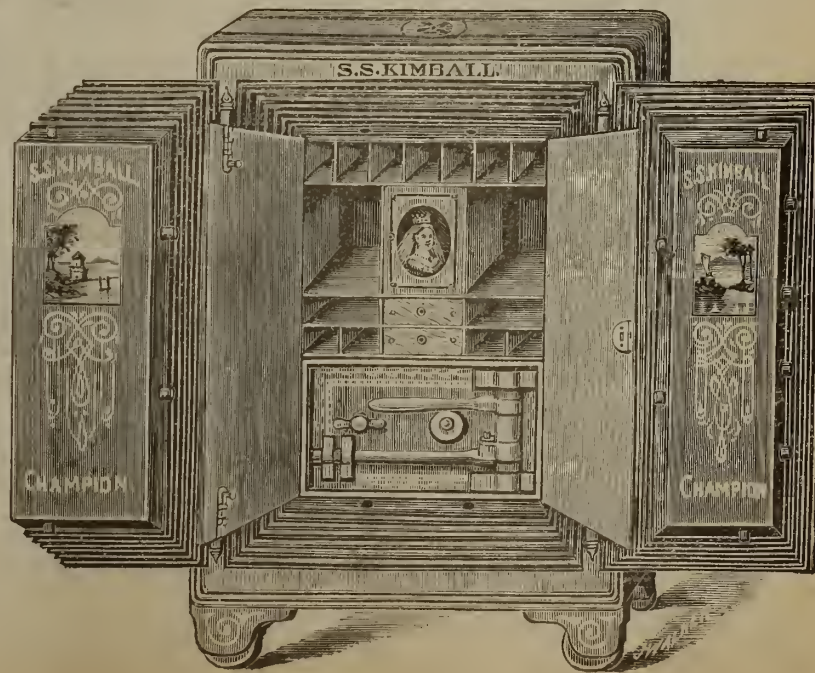
Readers of the REVIEW desiring extra copies of SCIENTIFIC AGRICULTURE should SEND IN THEIR ORDERS NOW. A few SPACES are still open and contracts may be made at reasonable rates. Address Manager, THE CANADIAN MINING REVIEW, OTTAWA.

Champion Fire and Burglarproof Safes.

These Safes have the best record of any in the Dominion. Price 30 per cent. cheaper than any other first-class Safe.

SEND FOR CATALOGUE AND PRICE-LIST.

S. S. KIMBALL,
577 Craig St., Montreal.





DEPARTMENT OF Inland Revenue.

AN ACT RESPECTING AGRICULTURAL FERTILIZERS.

The public is hereby notified that the provisions of the Act respecting AGRICULTURAL FERTILIZERS came into force on the 1st of January, 1886 and that all Fertilizers sold thereafter require to be sold subject to the conditions and restrictions therein contained—the main features of which are as follows:

The expression "fertilizer" means and includes all fertilizers which are sold at more than TEN DOLLARS per ton, and which contains ammonia, or its equivalent of nitrogen, or phosphoric acid.

Every manufacturer or importer of fertilizers for sale, shall, in the course of the month of January in each year, and before offering the same fertilizer for sale, transmit to the Minister of Inland Revenue, carriage paid, a sealed glass jar, containing at least two pounds of the fertilizer manufactured or imported by him, with the certificate of analysis of the same, together with an affidavit setting forth that each jar contains a fair average sample of the fertilizer manufactured or imported by him; and such sample shall be preserved by the

Minister of Inland Revenue for the purpose of comparison with any sample of fertilizer which is obtained in the course of the twelve months then next ensuing from such manufacturer or importer, or collected under the provisions of the Adulteration Act, or is transmitted to the chief analyst for analysis.

If the fertilizer is put up in packages, every such package intended for sale or distribution within Canada shall have the manufacturer's certificate of analysis placed upon or securely attached to each package by the manufacturer; if the fertilizer is in bags, it shall be distinctly stamped or printed upon each bag; if it is in barrels, it shall be either branded, stamped or printed upon the head of each barrel or distinctly printed upon good paper and securely pasted upon the head of each barrel, or upon a tag securely attached to the head of each barrel; if it is in bulk, the manufacturer's certificate shall be produced and a copy given to each purchaser.

No fertilizer shall be sold or offered or exposed for sale unless a certificate of analysis and sample of the same shall have been transmitted to the Minister of Inland Revenue and the provisions of the foregoing sub-section have been complied with.

Every person who sells or offers or exposes for sale any fertilizer, in respect of which the provisions of this Act have not been complied with—or who permits a certificate of analysis to be attached to any package, bag or barrel of such fertilizer, or to be produced to the inspectors to accompany the bill of inspection of such inspector stating that the fertilizer contains a larger percentage of the constituents mentioned in sub-section No. 11 of the Act than is contained therein—or who sells, offers or exposes for sale any fertilizer purporting to have been inspected, and which does not contain the percentage of constituents mentioned in the next preceding section—or who sells or offers or exposes for sale any fertilizer which does not contain the per-

centage of constituents mentioned in the manufacturer's certificate accompanying the same, shall be liable in each case to a penalty not exceeding fifty dollars for the first offence, and for each subsequent offence to a penalty not exceeding one hundred dollars. Provided always that deficiency of one per centum of the ammonia, or its equivalent of nitrogen, or of the phosphoric acid, claimed to be contained, shall not be considered as evidence of fraudulent intent.

The Act passed in the forty-seventh year of Her Majesty's reign, chaptered thirty-seven and entitled, "*An Act to prevent fraud in the manufacture and sale of agricultural fertilizers*," is by this Act repealed, except in regard to any offence committed against it or any prosecution or other act commenced and not concluded or completed, and any payment of money due in respect of any provision thereof.

A copy of the Act may be obtained upon application to the Department of Inland Revenue, as well as a copy of a Bulletin which it is proposed to issue in April, 1888, concerning the fertilizers

E. MIALL,
Commissioner.

January, 1889.



NOTICE

Is hereby given that all communications in respect to matters affecting the Department of Indian Affairs should be addressed to the Honorable E. Dewdney as Superintendent General of Indian Affairs, and not as Minister of the Interior, or to the undersigned. All Officers of the Department should address their official letters to the undersigned.

L. VANKOUGHNET,
Deputy Superintendent-General
of Indian Affairs.

Department of Indian Affairs,
Ottawa, 11th May, 1889.



Intercolonial Railway OF CANADA.

The direct route between the West and all points on the St. Lawrence and Baie des Chaleur, Province of Quebec; also for New Brunswick, Nova Scotia, Prince Edward, Cape Breton and the Magdalene Islands, Newfoundland and St. Pierre.

EXPRESS TRAINS leave Montreal and Halifax daily (Sunday excepted) and run through without change between these points in 30 hours.

The Through Express Train cars of the Intercolonial Railway are brilliantly lighted by electricity and heated by steam from the locomotive.

New and Elegant Buffet Sleeping and Day Cars are run on all through Express Trains.

The popular Summer Sea Bathing and Fishing Resorts of Canada are along the Intercolonial, or are reached by that route.

CANADIAN EUROPEAN MAIL AND PASSENGER ROUTE.

Passengers for Great Britain or the Continent by leaving Montreal on Thursday morning will join Outward Mail Steamer at Rimouski the same evening.

The attention of shippers is directed to the superior facilities offered by this route for the transport of flour and general merchandise intended for the Eastern Provinces and Newfoundland; also for shipments of grain and produce intended for the European market.

Tickets may be obtained and all information about the route, also Freight and Passenger rates, on application to

G. W. ROBINSON,
Eastern Freight and Passenger Agent,
137½ St. James St., MONTREAL.
E. KING,
27 Sparks Street,
OTTAWA.

D. POTTINGER,
Chief Superintendent.

Railway Offices, Moncton, N.B.
2nd July, 1889.

The Polson Iron Works Co'y TORONTO, ONT.

Manufacturers of the Celebrated "Brown Automatic Engine."

GENERAL DEALERS IN

MINING MACHINERY.

SPECIAL AGENTS FOR

Knowles' Steam Pumps,

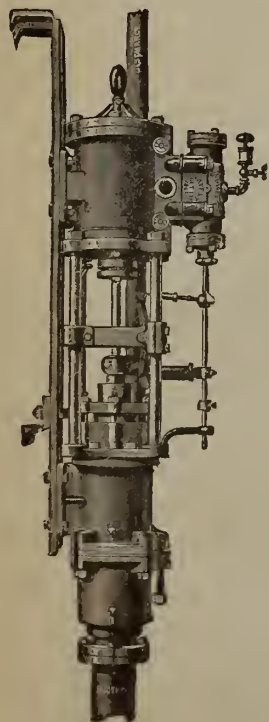
B. T. Sturtevant's Blowers and Fans,

Burleigh Rock Drills.

Hoisting Engines and Boilers, Quartz Mills, Diamond Prospecting Drills, Rock Breakers.

Office and Works, Esplanade E.; Warehouse, 38 Yonge St.,

TORONTO.





Mining Regulations

TO GOVERN THE DISPOSAL OF

Mineral Lands other than Coal Lands, 1886.

THESE REGULATIONS shall be applicable to all Dominion Lands containing gold, silver, cinnabar, lead, tin, copper, petroleum, iron or other mineral deposits of economic value, with the exception of coal.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein either by surface or subterranean prospecting for mineral deposits, with a view to obtaining under the Regulations a mining location for the same but no mining location or mining claim shall be granted until the discovery of the vein, lode or deposit of mineral or metal within the limits of the location or claim.

QUARTZ MINING

A location for mining, except for iron on veins, lodes or ledges of quartz or other rock in place, shall not exceed forty acres in area. Its length shall not be more than three times its breadth and its surface boundary shall be four straight lines, the opposite sides of which shall be parallel, except where prior locations would prevent, in which case it may be of such a shape as may be approved of by the Superintendent of Mining.

Any person having discovered a mineral deposit may obtain a mining location therefor, in the manner set forth in the Regulations which provides for the character of the survey and the marks necessary to designate the location on the ground.

When the location has been marked conformably to the requirements of the Regulations, the claimant shall within sixty days thereafter, file with the local agent in the Dominion Land Office for the district in which the location is situated, a declaration or oath setting forth the circumstances of his discovery, and describing, as nearly as may be, the locality and dimensions of the claim marked out by him as aforesaid; and shall, along with such declaration, pay to the said agent an entry fee of FIVE DOLLARS. The agent's receipt for such fee will be the claimant's authority to enter into possession of the location applied for.

At any time before the expiration of FIVE years from the date of his obtaining the agent's receipt it shall be open to the claimant to purchase the location on filing with the local agent proof that he has expended not less than FIVE HUNDRED DOLLARS in actual mining operations on the same; but the claimant is required, before the expiration of each of the five years, to prove that he has performed not less than ONE HUNDRED DOLLARS' worth of labor during the year in the actual development of his claim, and at the same time obtain a renewal of his location receipt, for which he is required to pay a fee of FIVE DOLLARS.

The price to be paid for a mining location shall be at the rate of FIVE DOLLARS PER ACRE, cash, and the sum of FIFTY DOLLARS extra for the survey of the same.

No more than one mining location shall be granted to any individual claimant upon the same lode or vein.

IRON.

The Minister of the Interior may grant a location for the mining of iron, not exceeding 160 acres in area which shall be bounded by north and south and east and west lines astronomically, and its breadth shall equal its length. Provided that should any person making an application purporting to be for the purpose of

mining iron thus obtain, whether in good faith or fraudulently, possession of a valuable mineral deposit other than iron, his right in such deposit shall be restricted to the area prescribed by the Regulations for other minerals, and the rest of the location shall revert to the Crown for such disposition as the Minister may direct.

The regulations also provide for the manner in which land may be acquired for milling purposes, reduction works or other works incidental to mining operations.

Locations taken up prior to this date may, until the 1st of August, 1886, be re-marked and re-entered in conformity with the Regulations without payment of new fees in cases where no existing interests would thereby be prejudicially affected.

PLACER MINING.

The Regulations laid down in respect to quartz mining shall be applicable to placer mining as far as they relate to entries, entry fees, assignments, marking of localities, agents' receipts, and generally where they can be applied.

The nature and size of placer mining claims are provided for in the Regulations, including bar, dry, bench, creek or hill diggings, and the RIGHTS AND DUTIES OF MINERS are fully set forth.

The Regulations apply also to

BED-ROCK FLUMES, DRAINAGE OF MINES AND DITCHES.

The GENERAL PROVISIONS of the Regulations include the interpretation of expressions used therein; how disputes shall be heard and adjudicated upon; under what circumstances miners shall be entitled to absent themselves from their locations or diggings, etc., etc.

THE SCHEDULE OF MINING REGULATIONS

Contains the forms to be observed in the drawing up of all documents such as:— "Application and affidavit of discoverer of quartz mine." "Receipt for fee paid by applicant for mining location." "Receipt for fee on extension of time for purchase of a mining location." "Patent of a mining location." "Certificate of the assignment of a mining location." "Application for grant for placer mining and affidavit of applicant." "Grant for placer mining." "Certificate of the assignment of a placer mining claim." "Grant to a bed rock flume company." "Grant for drainage." "Grant of right to divert water and construct ditches."

Since the publication, in 1884, of the Mining Regulations to govern the disposal of Dominion Mineral Lands the same have been carefully and thoroughly revised with a view to ensure ample protection to the public interests, and at the same time to encourage the prospector and miner in order that the mineral resources may be made valuable by development.

COPIES OF THE REGULATIONS MAY BE OBTAINED UPON APPLICATION TO THE DEPARTMENT OF THE INTERIOR.

A. M. BURGESS,

Deputy Minister of the Interior.

SEND FOR SAMPLES AND PRICES FOR

Asbestos Bags, Phosphate Bags, Ore Bags, &c.,

SPECIAL SIZES MADE TO ORDER.

DOUBLE SEWN.

DICK, RIDOUT & CO.,

PROPRIETORS TORONTO BAG WORKS,-

Office and Warehouse: 11-13 Front St. East. Factory: 14, 16, 18, 20, 22 Bay St.

TORONTO.

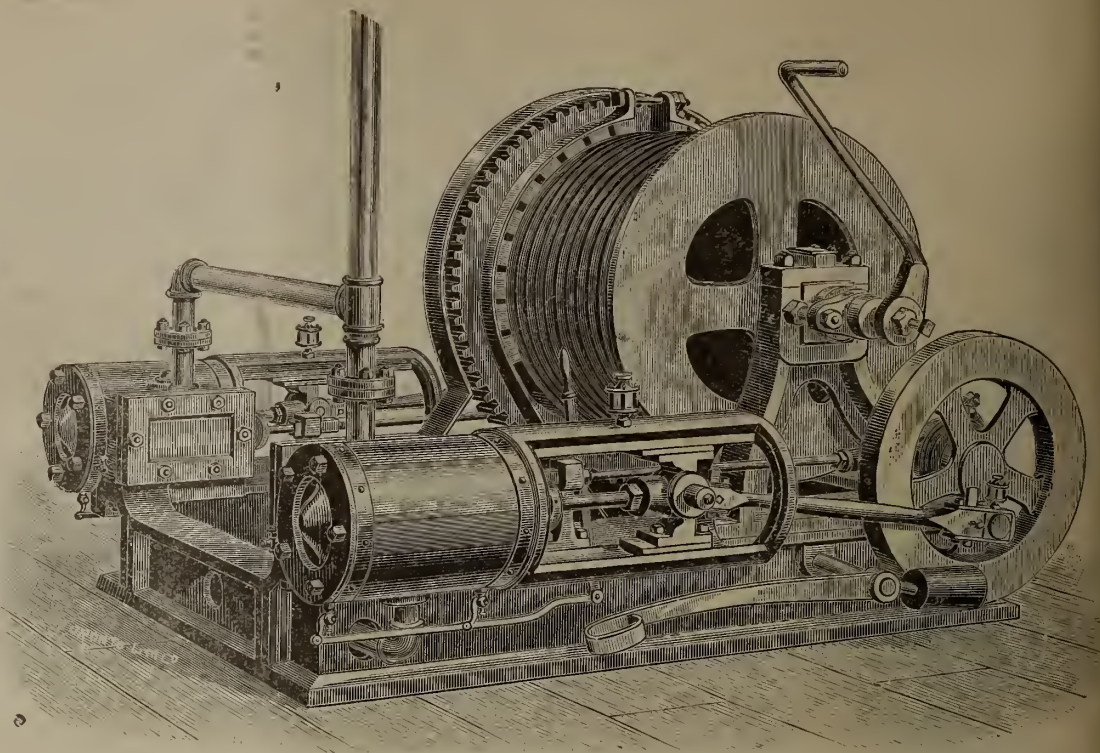
ESTABLISHED 1887.

JOHN DOTY ENGINE CO.

Toronto, Ont.

MANUFACTURERS OF

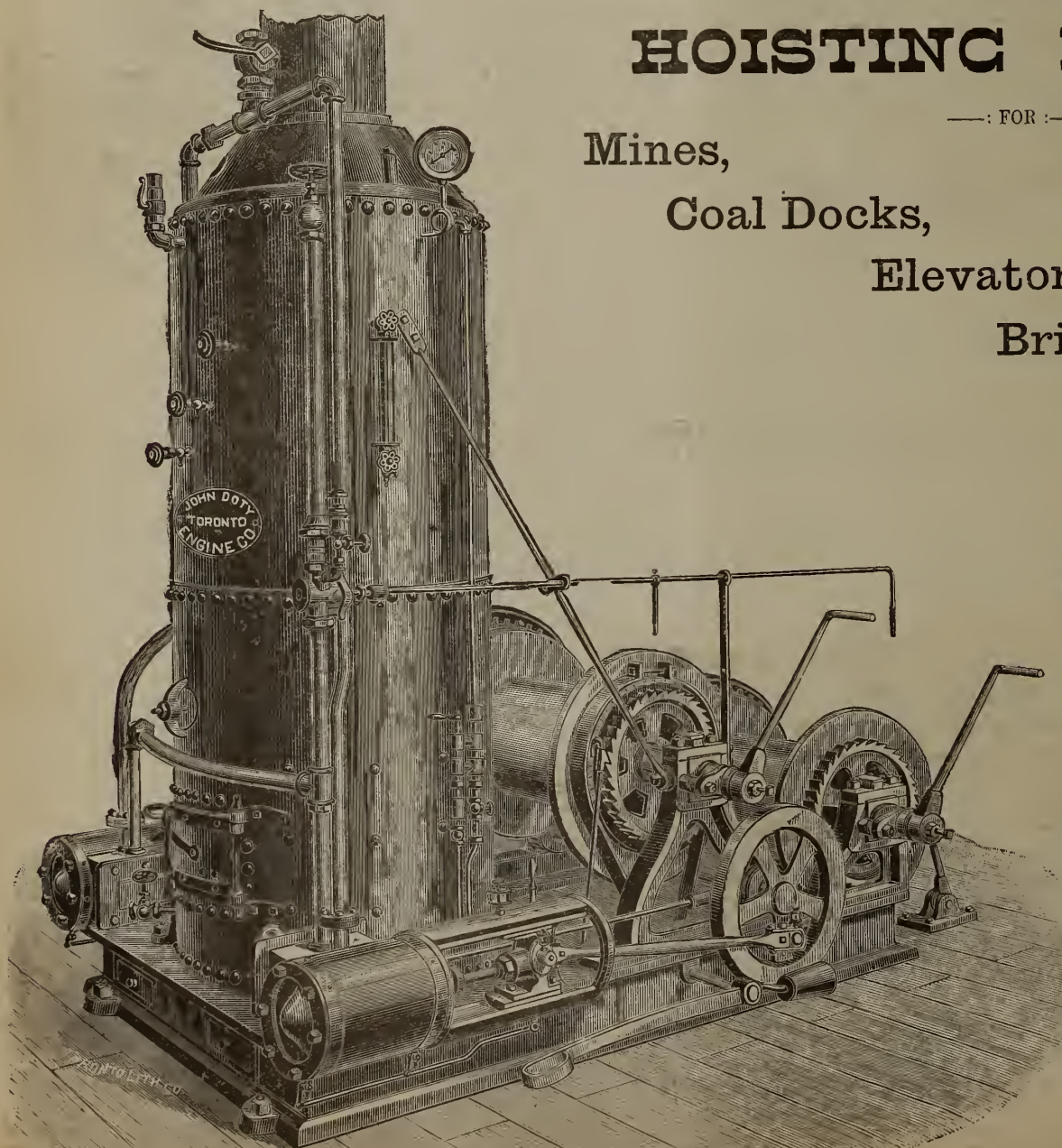
Mining & General
Machinery.



HOISTING ENGINES

—: FOR :—

Mines,
Coal Docks,
Elevators,
Bridge Builders,
Contractors, &c.



CORLISS ENGINES

Tug & Steam Yacht Engines,
Mill Engines.

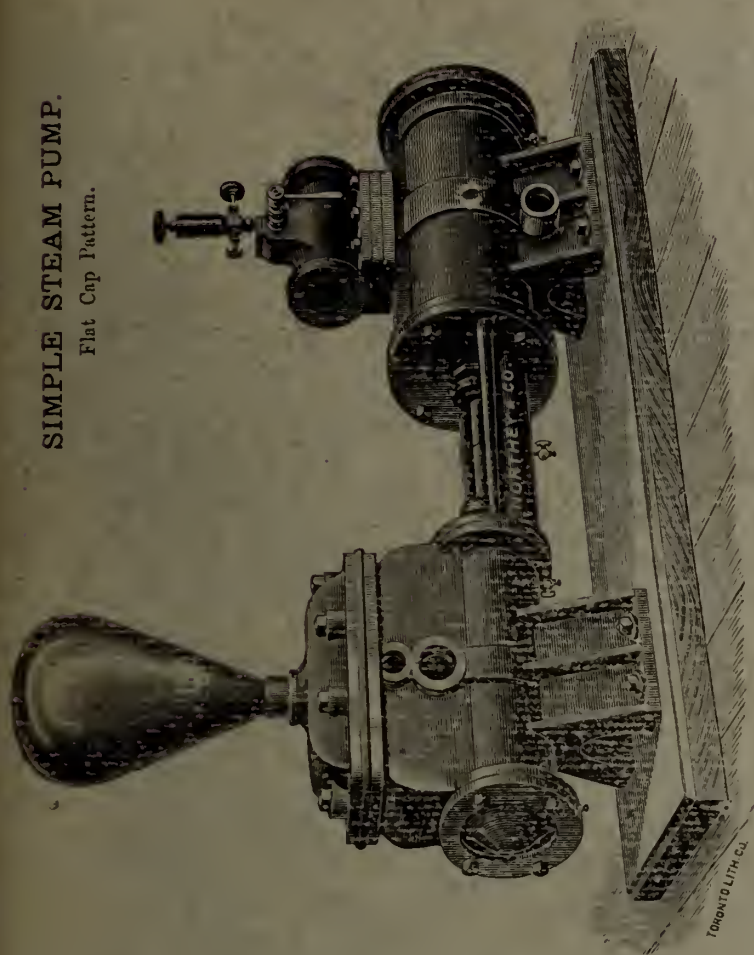
Shafting & Mill
Gearing.

All Descriptions of Boiler
and Tank Work.

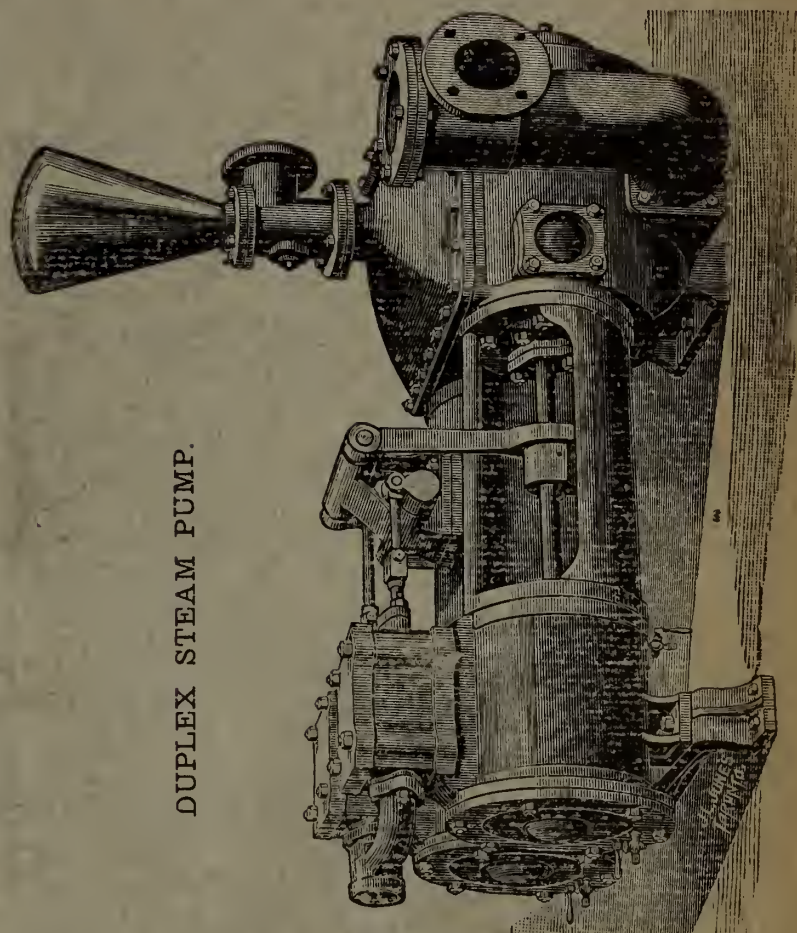
Send for Estimates and
Catalogues.

Northey & Co's Steam Pump Works, TORONTO, ONT.

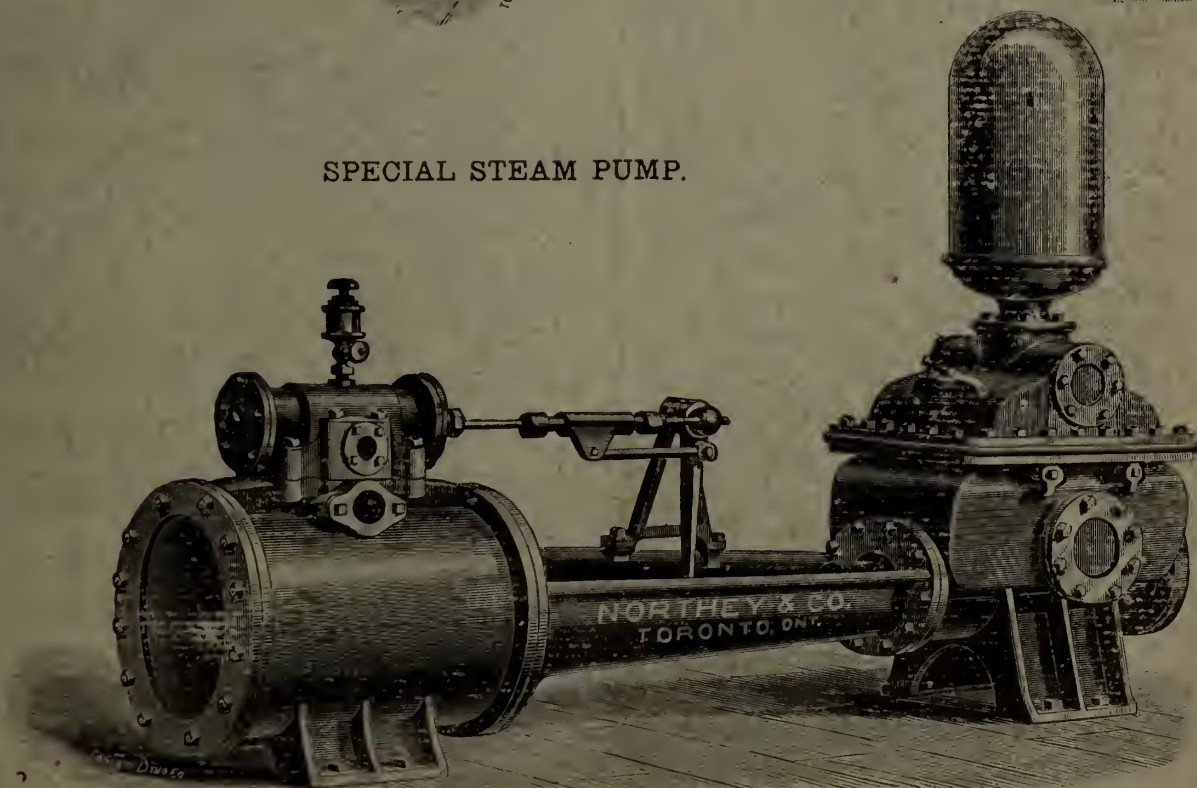
SIMPLE STEAM PUMP.
Flat Cap Pattern.



DUPLEX STEAM PUMP.



SPECIAL STEAM PUMP.



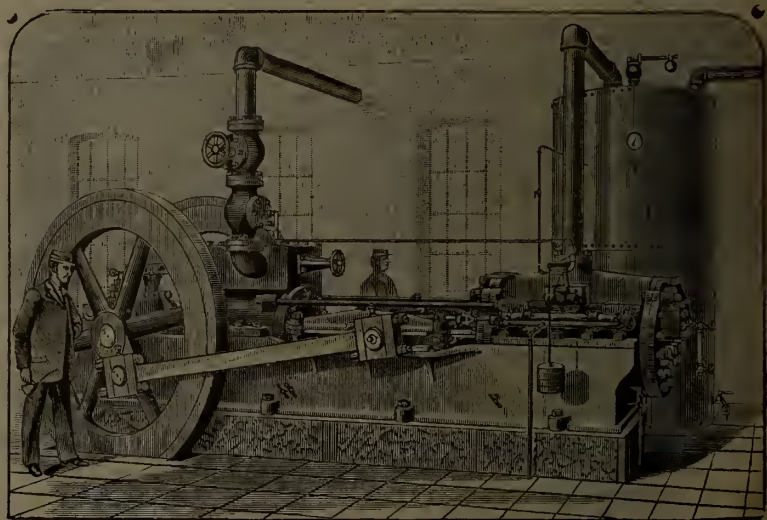
Steam Pumps of the best and latest designs for mining purposes, Boiler Feeding, Fire Protection, and General Water Supply, etc

NORTHEY & CO.,
Mechanical  Hydraulic Engineers, Toronto, Ont.
WORKS—COR. FRONT AND PARLIAMENT STS.

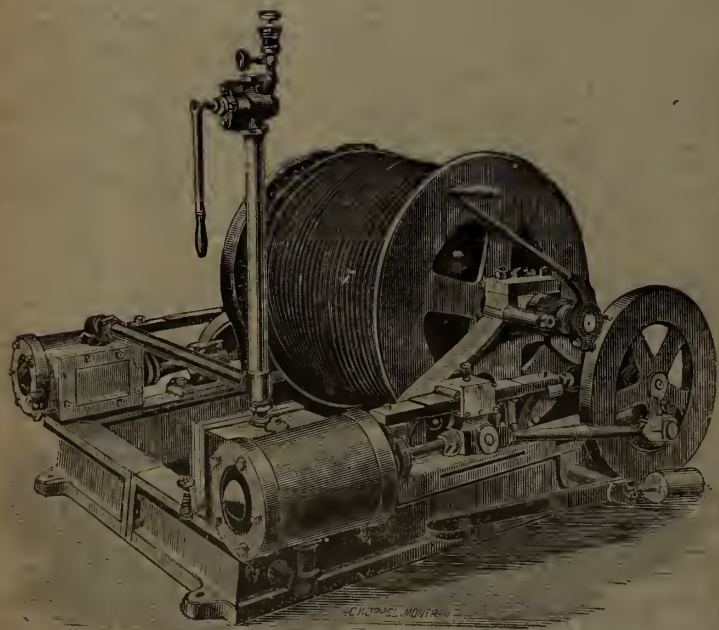


INGERSOLL
ROCK DRILL COMP'Y
OF CANADA
MANUFACTURERS OF

Rock Drills,
Air Compressors,
Steam & Horse Power Hoists,
BOILERS,
GENERAL MINING
Quarrying Machinery
Contractors' Plant.



— ALSO —



Drill Steel, Wire Rope,
Derrick Castings,
Steam & Air Hose & Couplings,
Iron Piping, Fittings,
ALL KINDS [OF SUPPLIES
—FOR—
Miners & Contractors' Work.

For Estimates, Catalogues and information address

Ingersoll Rock Drill Co. of Canada

204 St. James St., or P.O. Box 1942, Montreal.

MINING REVIEW

Canadian

Established 1882

Vol VIII.—No. II.

1889.—OTTAWA, NOVEMBER—1889.

Vol. VIII.—No. II.

1889 CATALOGUE OF 200 PAGES, 1889

ROCK DRILLING AND AIR COMPRESSING,

This Catalogue is one of unusual interest and value.—*R.R. Gazette*.
 Should be in the hands of every engineer and Contractor.—*Eng. and Min. Journal*.
 Supplies a long felt want.—*Manufacturers Record*.
 This is a thoroughly good publication.—*Engineering News*.
 A valuable addition to the literature on the subject.—*Eng and Btg Record*.
 The matter is readily available.—*Tradesman*.
 A Complete Work.—*Colliery Engineer*.
 Handy for reference.—*Min. and Sc. Press*.
 The Useful Information will be specially valuable.—*Eng. and Btg. Record*.
 Is really a hand book.—*Am. Manufacturer*.

RAND DRILL CO.,
 23 PARK PLACE, NEW YORK.

Hamilton Powder
 COMPANY,
 Manufacture Mining, Blasting, Military
 and Sporting
Gunpowder,
 DYNAMITE, DAULIN, and the new
ECLIPSE MINING POWDER

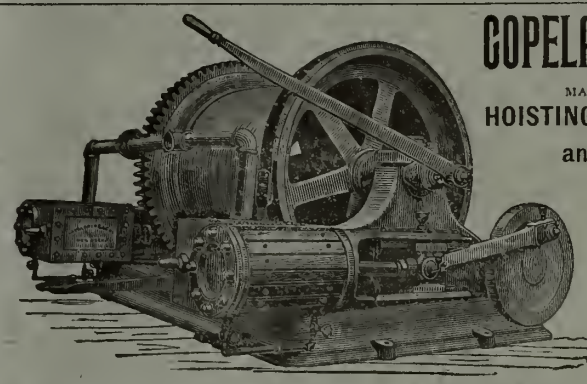
DOMINION AGENTS FOR
 Safety Fuse, Electric Blasting
 Apparatus, &c.
 OFFICE
 103 ST. FRANCOIS XAVIER STREET
 MONTREAL.

BRANCH OFFICES & MAGAZINES
 at all chief distributing points
 in Canada.

LICENSES
 —TO—
 PROSPECT OR WORK
MINERALS
 ON ANY OF THEIR
 Lands and Reservations
 COVERING NEARLY A
Quarter of a Million Acres

In Eastern Ontario and principally within
 the belts containing
 Iron, Phosphate, Gold, Galena,
 Plumbago, Mica, Marbles,
 Building Stone,
 And other valuable Minerals, are issued by

The CANADA CO.
 For list of lands and terms apply to the
 Company's Mining Inspectors,
 H. T. STRICKLAND,
 Peterborough, Ont.,
 For lands in the County of Hastings and
 westward, and
 ANDREW BEEL, P.L.S.,
 Almonte, Ont.,
 For lands East of the County of Hastings.

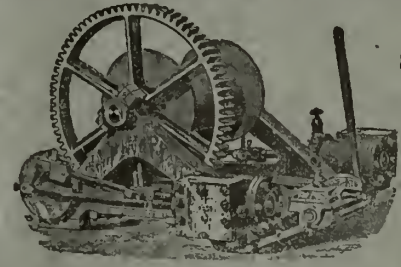


COPELAND & BACON
 MANUFACTURERS OF
 HOISTING ENGINES,
 and MINING PLANTS.

85 Liberty St.
 NEW YORK.

Send for Catalogue.

MILLER BROS. & MITCHELL



MANUFACTURERS OF
steam Rock Drills
 AND
 HOISTING ENGINES,
 Mining & Contractors' Plant
 &c., &c.
 110 TO 120 KING STREET, MONTREAL, QUE.

THE
BELL TELEPHONE CO.
 OF CANADA.

ANDREW ROBERTSON, - - PRESIDENT
 C. F. SISE, - - VICE-PRESIDENT
 C. P. SCLATER, - SECRETARY-TREASURER

HEAD OFFICE, - MONTREAL.
 H. C. BAKER, Manager Ontario Department,
 HAMILTON.

This Company will sell its instruments at prices
 ranging from \$10 to \$25 per set. These instru-
 ments are under the protection of the Company's
 patents, and purchasers are therefore entirely free
 from risk of litigation.

This Company will arrange to connect places
 not having telegraphic facilities with the nearest
 telegraph office, or it will build private lines for
 firms or individuals, connecting their places of
 business or residences. It is also prepared to
 manufacture all kinds of electrical apparatus.

Full particulars can be obtained the at Com-
 pany's offices as above, or at St. John, N.B., Hal-
 lax, N.S., Winnipeg, Man., Victoria, B.C.

SOCIETE
Canadienne d'Etudes Minieres.
 CAPITAL. - - \$100,000
 Assaying, Prospecting and Mining.

HEAD OFFICE, 30 St. FRANCOIS XAVIER ST.
 P. O. Box 1625, MONTREAL.
 Office in Paris (France) 12 Place Vendome.

DIRECTORATE:
 M. SCHWOB, Vice Consul of France, President.
 JOHN S. HALL, Q.C., M.P.P., Vice-President.
 C. A. DUGAS, Judge of Sessions } Directors.
 C. H. A. GRANT, }
 C. DUQUET, Alderman, Quebec, }
 G. WERNER, Secretary and Treasurer.
 L. DE LA VALLÉE POUSSIN, I.C.P., Consulting
 JOHN D. FROSSARD, M.E., Engineers.
 JOHN S. HALL, Q.C., M.P.P., Advocate, Legal
 Adviser of the E. L.

ALEX. FLECK JUN.,
 Manufacturer of every Description of
Mill Machinery

Water Wheels, Steam Engines,
Boilers, Derricks, Steam
Pumps and Mining
Machinery.
 Brass and Iron Casting of every
 Description.

VULCAN IRON WORKS, WELLINGTON ST.
OTTAWA.

DYNAMO ELECTRIC
MACHINES and LAMPS



ARC and INCANDESCENT
FOR MINING PURPOSES

BLACK DIAMOND
 STEEL WORKS.
 TRADE MARK
 LAKE SUPERIOR
 COPPER MILLS.

PARK, BROTHER & Co.
 (LIMITED.)
BLACK DIAMOND STEEL,

The best for Mining and General Purposes.
 Large and well assorted Stock.

377 St. Paul St., MONTREAL.

New York Belting & Packing Co.

15 PARK ROW, NEW YORK

JOHN H. CHEEVER, Treasurer.

J. D. CHEEVER, Dep'y Treasurer.

Oldest and largest Manufacturers in the United States of



RUBBER BELTING.

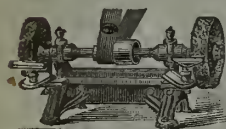
CIRCULAR WOVEN SEAMLESS, ANTI-SEPTIC RUBBER LINED

"CABLE" HOSE & TEST HOSE

For the use of Steam Engines, Force Pumps, Rolling Mills, Iron Works, Factories, etc. Woven in a superior manner to insure wear, compactness and durability.



"TEST HOSE."



Emery Vulcanite Wheel.

SOLID VULCANITE EMERY WHEELS

(Large Wheels made on iron centers)

Cuts Cooler and Freer than any other wheel in the market.

SALESROOMS:—Chicago, 151 Lake St.; Detroit, 16-24 Woodward Ave.; Boston, 52 Summer St.; Cleveland, 176 Superior St.
European Branch: Pickhuben, 5, Hamburg (Freihafenarbeit), Germany.

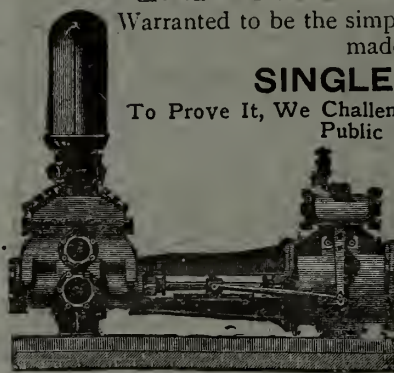
The M. T. DAVIDSON

IMPROVED MINING PUMP.

Warranted to be the simplest and most efficient Steam Pump made, whether it be

SINGLE OR DUPLEX.

To Prove It, We Challenge All Makers of Steam Pumps to a Public Competitive Test.



COMPOUND PUMPING ENGINES,

Obtaining a higher duty than any direct-acting pump made.

MANUFACTURED BY THE

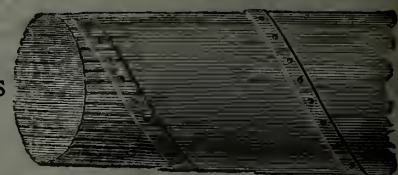
Davidson Steam Pump COMPANY,

New York Office, - - - 77 Liberty Street.

ROOT'S SPIRAL RIVETED PIPE

FOR

Hydraulic Mining,
Water Works
Ranch and Railroad
Water Supplies.



From 2 to 24 inches in diameter and 1 to 25 in length. Manufactured with fittings to suit, capable of withstanding any desired pressure.

ABENDROTH & ROOT MFG. CO.

28 Cliff Street, New York.

Chicago Branch, - - SMITH & KNAPP, 62 South Canal Street

LIDGERWOOD MANUF'G CO.

96 LIBERTY ST, NEW YORK,

34 & 36 WEST MONROE ST. CHICAGO, 197 TO 203 CONGRESS ST. BOSTON,

Largest Manufacturers in the United States of Hoisting Machinery of Every Description for Mines, Tunnel Work, Contractors, and General Hoisting Purposes.

IMPROVED HOISTING ENGINES

FOR MINING PURPOSES A SPECIALTY.

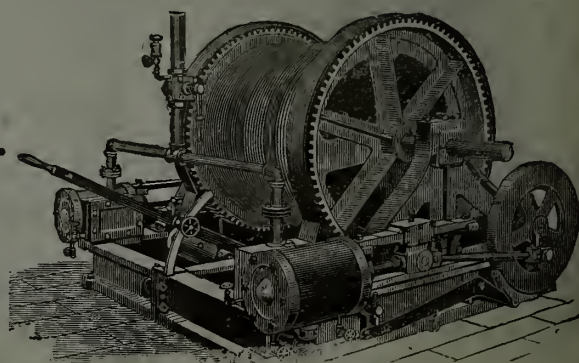
Over 5,000 Engines in Use!

300 Styles
and Sizes.

Send for
CATALOGUE.



FRICTION DRUM PORTABLE HOISTING ENGINE.



Double Cylinder Reversible Mine Engine.

F. G. BECKETT ENGINE CO.

HAMILTON, ONT.



Having had many years practical experience in the manufacture of

MINING MACHINERY

IS NOW PREPARED TO CONTRACT FOR

Stamp Mill Machinery,
Concentration Mills,
Revolving, Roasting and
Drying Furnaces.
Rock Breakers,
Cornish Rolls for crushing,
Amalgamating Pans and Settlers,
Concentrators and
Revolving Screens,
Smelting Furnaces, Retorts,

HOISTING ENGINES,

EITHER GEARED OR DIRECT ACTION.

Cornish Pumping Machinery,
Iron Ore Cars, Safety Cages, &c.,
Rock Drills and Air Compressors.

STEAM ENGINES AND BOILERS.

Marine Engines and Steam Yachts.

Francis D. Taylor

MINING ENGINEER,

BROCKVILLE, - ONTARIO

SPECIALTY. — The Mining of Iron Ores, Coals, and the Manufacture of Iron and Steel.

Mr. T. has had for many years the management of large mining enterprises in England and the U. S. A.

CAMERON STEAM PUMP
SIMPLE, RELIABLE, COMPACT, DURABLE.

NO OUTSIDE VALVE GEAR.

THE A. S. CAMERON STEAM PUMP WORKS.

ADAPTED FOR ALL PURPOSES.

FOOT OF EAST 23rd STREET, NEW YORK.



DOMINION ASSAY OFFICE AND MINING BUREAU.

Prospecting, Surveying and Examinations by Experts. Mining properties purchased or floated on the European markets; Capital found for developing same. Interest in good mining property secured.

London Office: 21 Richmond St. E. } TORONTO
33 King St., Cheapside. 44 Victoria St.

**TAYLOR McVEITY,
Barrister, Solicitor, &c.,**

Supreme Court and Departmental Agent,
SCOTTISH ONTARIO CHAMBERS, OTTAWA.

WM. HAMILTON MERRITT, F.C.S.

Associate Royal School of Mines, &c.,
Mining Engineer and Metallurgist,
Will report on Mines and Mineral Properties.

ADDRESS:
15 TORONTO ST., TORONTO, ONT.

J. T. DONALD, M.A.,

Analytical Chemist and Assayer,
124 St. JAMES St. - MONTREAL
Analyses and Assays of every description. Manufacturing processes practically tested. Laboratory instruction in Chemistry, Assaying and Mineralogy. Terms on application.

**THE DOMINION
Leather Board Co.**

MONTREAL,

—MANUFACTURERS OF—
Leather Board & Stiffeners

ALSO OF

**ASBESTOS MILL BOARD,
STEAM PACKING, and
FRICTION PULLEY BOARD.**

Samples and prices furnished upon application.
Please mention this paper.



**ONTARIO
Mining Regulations.**

The following summary of the principal provisions of the General Mining Act of the Province of Ontario is published for the information of those interested in mining matters in the Algoma District, and that part of the Nipissing District north of the Mattawan River, Lake Nipissing and French River.

Any person or persons may explore for mines or minerals on any Crown Lands surveyed or unsurveyed, not marked or staked out or occupied.

The price of all lands sold as mining locations or as lots in surveyed townships is two dollars per acre cash, the pine timber being reserved to the Crown. Patentees or those claiming under them may cut and use such trees as may be necessary for building, fencing or fuel, or for any other purpose essential to the working of mines.

Mining locations in unsurveyed territory shall be rectangular in shape, and the bearings of the outlines thereof shall be due north and south, and due east and west astronomically, and such locations shall be one of the following dimensions, viz: eighty chains in length by forty chains in width, containing 320 acres, or forty chains square, containing 160 acres, or forty chains in length by twenty chains in width, containing 80 acres.

All such locations must be surveyed by a Provincial Land Surveyor, and be connected with some known point or boundary at the cost of the applicant, who must file with an application surveyor's plan, field notes and description of location applied for.

In all patents for mining locations a reservation of five per cent. of the acreage is made for roads.

Lands patented under the Mining Act are free from all royalties or duties in respect to any ores or minerals thereon, and no reservation or exception of any mineral is made in the patents.

Lands situated south of the Mattawan River, Lake Nipissing and French River are sold under the Mining Act at one dollar per acre cash.

Affidavits showing no adverse occupation, improvement or claim should accompany applications to purchase.

A. S. HARDY,

Commissioner,
Department of Crown Lands, Toronto.

**CANADA ATLANTIC
RAILWAY.**

THE SHORTEST PASSENGER ROUTE
BETWEEN

Ottawa and Montreal,

AND ALL POINTS EAST & SOUTH.

The only road in Canada running trains lighted with electricity and heated by steam from the engine. Luxurious Buffet Pullman Palace Cars on all trains between Ottawa and Montreal. Only line running through Sleeping Cars between

Ottawa, Boston and New York

And all New England and New York points.

Baggage checked to all points and passed by Customs in transit.

For Tickets, Time Tables and information apply to nearest agent, or to

S. EBBS, City Passenger Agent,
24 Sparks St., OTTAWA.

GEO. H. PHILLIPS, Gen. Agent,
VALLEYFIELD.

A. E. CAIRNS, General Agent,
136 St. James St., MONTREAL.

Or at 260 Washington St., Boston, and
317 Broadway, New York.

PERCY R. TODD,
General Passenger Agent

E. J. CHAMBERLAN,
General Manager,
General Offices, Ottawa.

TO MINERS AND OTHERS.

Bannerman & Powers,

VULCAN BOILER WORKS,

428 and 340 Wellington St., Ottawa.

MANUFACTURERS OF

IRON AND STEEL BOILERS

OF EVERY DESCRIPTION.

Tanks, Girders, Iron Roofing, Bank Vaults, Smoke Stacks

—AND ALL KINDS OF—

SHEET IRON WORK.

Repairs Neatly and Promptly Executed

FENWICK & SCLATER,

Manufacturers of Asbestos, Fire Hose, Files and Cotton Waste, Miners of Asbestos and Soapstone,

ASBESTOS

Cotton, Leather and Rubber Belting,

42, 44 & 46 Foundling Street, Montreal.

H. R. IVES & CO.,

Hardware Manufacturers and Founders,
QUEEN ST., MONTREAL.

STOVES.	PORTABLE FORGES.	MONTREAL SMELTING CO'S	CASTINGS
TRADE MARK "Buffalo"	BLACKSMITH'S DRILLS.	BABBIT METAL.	Of every description to order.
IRON BEDSTEADS			SOIL PIPE.
FOR MINERS' USE.			

PORTABLE ENGINES AND SAW-MILLS

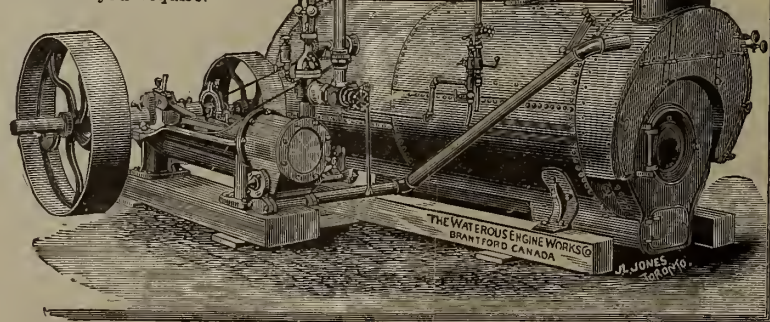
Of all capacities—from 3000 feet of lumber and up per day.

Saw-Mills. Shingle-Mills. Lath-Mills. Chopping-Mills.

OF ALL SIZES.

BOILERS of all capacities, IRON OR STEEL, ALL STYLES.

Send for Circulars, stating what you require.



Waterous Engine Works Co. Brantford, Canada.
St. Paul, Minn., U.S.A.

JOHN E. HARDMAN, S.B.
MINING ENGINEER,
OLDHAM, NOVA SCOTIA.

Can be consulted on all matters pertaining to the profession.

The development and management of Gold Properties a specialty.

WILSON & GREEN,
Commission Merchants,
PHOSPHATE SHIPPERS.
AGENTS HIGH ROCK MINE.

30 St. François Xavier St., - MONTREAL.

EDMUND SPARGO,
 Consulting and Mining Engineer, 3 Cable Street,
 Liverpool.

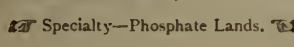
Owners of or Investors in Metalliferous Mines, Slate, Granite, and other Stone Quarries, Brick, Terra Cotta, Fire and other Clays and Mineral Estates in general, requiring reliable and sound advice either in the Purchase or Disposal thereof, should consult E.S., who has executed important professional Commissions in Germany, Austria, Hungary, France, Belgium, Spain, Portugal, Sweden, Norway, and in the various Mining Districts throughout Great Britain and Ireland. Telegraphic Address: "Spargo," Liverpool. Bankers, National Provincial Bank of England, Liverpool.

THOMAS HEYS,
 Analytical and Consulting Chemist and Assayer.

References are kindly permitted by the following:
 Messrs. Gooderham & Worts, Toronto, Limited; Messrs. P. R. Lamb & Co.; John Livingston, Esq., Dominion Bolt Co.
 Assay and Analytical Laboratory
 16 King St. West, opposite the Rossin House, } **TORONTO.**

J. LAINSON WILLS,
F. C. S., ETC.
 Late Manager Canadian Phosphate Co. (Lim.),
 Reports upon Mines and Mining properties.
 Advice given on Chemical and Metallurgical processes.
SPECIALTIES: PHOSPHATE AND GOLD.
 TELEGRAPHIC OR POSTAL ADDRESS:
WILLS, BUCKINGHAM, P.Q.

Irwin, Hopper & Co.
MINERS AND SHIPPERS OF MINERALS,
30 St. Francois Xavier Street,
MONTREAL, CAN.
 Asbestos, crude and manufactured. Phosphate, Mica, Plumbago, Soapstone, &c.

JOHN D. FROSSARD, B.S., M.E.
MINING ENGINEER & GEOLOGIST,
30 St. Francois Xavier St., - - Montreal.
 Specialty—Phosphate Lands. 

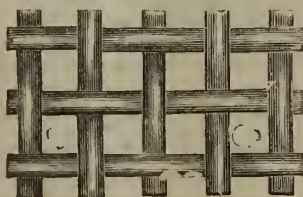
JAMES HOPE & CO.
BOOKSELLERS,
Stationers, Bookbinders and Printers,
OTTAWA.

SPEIGHT & VanNOSTRAND,
Dominion and Provincial Land Surveyors,
Draughtsmen, Valuers, &c.
 OFFICE: ROOM "J," FIRST FLOOR, TORONTO ARCADE,
 YONGE ST., TORONTO.
 Surveys, Plans, Descriptions of Properties, etc., promptly executed.
 Timber Limits and Mining Claims Located.

MILLAR & CO.
General Merchants & Shipping Agents
 ATLANTIC CHAMBERS,
 209 COMMISSIONER ST., - MONTREAL
 Cable address, "Hoyer, Montreal." P.O. Box 1095.
 AGENT FOR The Canadian Phosphate Co., Ltd., of London, Eng.,
 The Montreal Union Abattoir Co., of Montreal, Can.
 English Correspondents Messrs. Couper, Millar & Co., London, England.



For Mining Hoisting Derricks, etc.



Strong Wire Cloth and Screens
 For Mining, etc., manufactured by
The B. Greening Wire Co., Ltd.,
 HAMILTON, ONT.

	THIS SPACE	
	OPEN FOR CONTRACT.	



SEALED TENDERS addressed to the undersigned, and endorsed "Tender for Hot Water Heating Apparatus, Prescott, Ont., will be received until Wednesday, 18th December next, for the construction of a Hot Water Heating Apparatus at the Prescott, Ont., Post Office, and Custom House Buildings.

Plans and specifications can be seen and form of tender and all necessary information obtained at this Department and at the Clerk of Works Office, Prescott, Ont., after Wednesday, 4th December next.

Persons tendering are notified that tenders will not be considered unless made on the printed form supplied, and signed with their actual signatures.

Each tender must be accompanied by an accepted bank cheque made payable to the order of the Honorable the Minister of Public Works, equal to five per cent. of the amount of the tender, which will be forfeited if the party decline to enter into a contract when called upon to do so, or if he fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department will not be bound to accept the lowest or any tender.

By Order,
 A. GOBEIL,
 Secretary.
 Dept. of Public Works,
 Ottawa, November, 28th, 1889.

W. Blakemore, G.S., M.E., F. Member of I. & S.I. | A. Montgomery Evans, M.E. of Canada & U.S.

BLAKEMORE & EVANS,
MINING & CIVIL ENGINEERS
Exchange Buildings, Cardiff, S.W.

LONDON OFFICE:
 Robert H. Jones, 82 Queen St., Cheapside, London, E.C.

Reports, Estimates, and Valuations made on Iron and Steel Works
 Blast Furnaces, and all classes of Mining Properties.

CANADIAN BUSINESS PROMPTLY ATTENDED TO.

To Prevent Boiler Explosions
 And other accidents to steam boilers, and to secure economy in working, insure with

THE BOILER INSPECTION
AND INSURANCE COMPANY OF CANADA.

Sir Alex. Campbell, K.C.M.G., | John L. Blaikie, Esq.
 President. Vice-Pres.

HEAD OFFICE: TORONTO
 G. C. ROBB, Chief Engineer.
 A. FRASER, Sec'y-Treas.

ORFORD COPPER CO.,
COPPER SMELTERS.

Works at Conistable's Hook, N.J., opposite new Brighton, Staten Island. Copper Ore, Mattes, or Bullion purchased. Advances made on consignments for refining and sale. Specialty made of Silver-Bearing Ores and Mattes.

SELL
INGOT AND CAKE COPPER.
 President, **ROBERT M. THOMPSON,**
 Treasurer, **G. A. LAND.**
 Office, 37 to 39 Wall Street, New York.

Robin & Sadler,
 MANUFACTURERS OF
LEATHER BELTING.

TRY OUR
Waterproof Belting,
 Just the thing for Mining Machinery.
 MONTREAL, TORONTO,
 2518, 2520, 2522 Notre Dame St. 129 Bay Street.

Diamonds, Jewelry, Watches & Silverware
AT ROSENTHAL'S
Goldsmith's Hall, 87 Sparks St.
OTTAWA.

T. D. LEDYARD,
DEALER IN MINERAL LANDS
 4 ONTARIO CHAMBERS, TORONTO.

Will buy undeveloped iron ore and other mineral properties.
 WANTED. — Deposits of Magnetic Iron Ore, Red Hematite, Brown Hematite, Galena, Iron and Copper Pyrites, Mica, Soapstone, Marble, Gypsum, Baryta. Samples can be sent by Sample Post for 1 cent for 4 oz. or up to 24 oz. in weight.
 Information regarding mines cheerfully given. Correspondence solicited. Crown Land Business attended to.

FIRE FELT

is a new Non-Conducting material, made into sections to fit any size of pipe, and into rolls and sheets for large surfaces. It is a flexible felt-like fabric, made of pure Asbestos. It has been demonstrated by the U. S. Navy and others to be superior to hair felt as a non-conductor, and is indestructible by heat. Covering your Steam or Hot Air Pipes will save from 10 to 40 per cent. in fuel and give dry steam at long distances.

SOLE MANUFACTURERS

The Chalmers-Spence Co.,

Largest Consumers of Asbestos in the World.

419 to 425 E. Eighth Street, NEW YORK.

DODGE PATENT

Wood Separable Split Pulleys

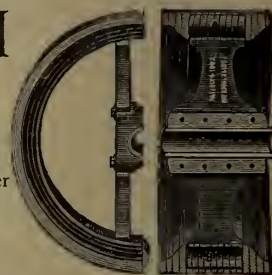
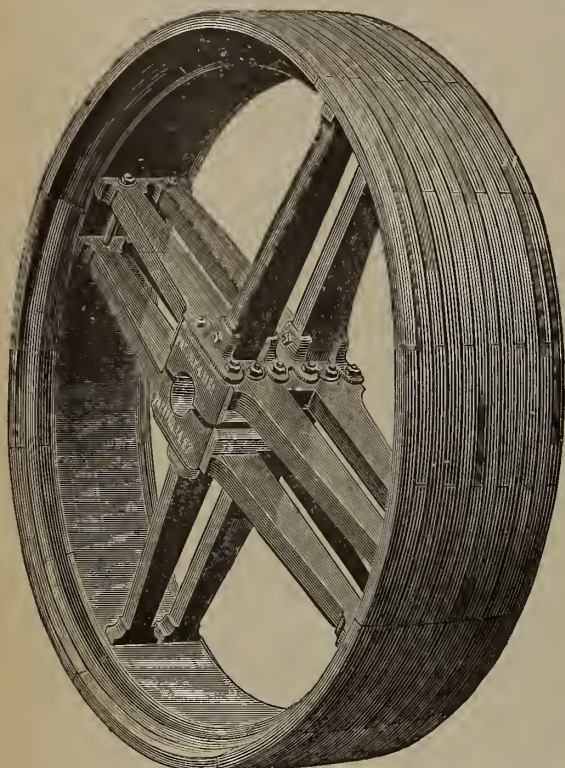
Best Belt Surface, Lightest, Strongest, Best Balanced and Most Convenient Pulley in the World.

WITH OUR PATENT BUSHING SYSTEM

In Comparing Prices of Pulleys please note carefully the following:

1. Our list is lower than most others.
2. Every Pulley is a Split Pulley.
3. Every Pulley is guaranteed to transmit from 25 to 60 per cent. more power than an iron one with same tension of belt.
4. Our Pulleys are 70 per cent. lighter than iron pulleys.
5. The fastening does not mar the shaft.
6. They are perfect in Balance.
7. They can be used on many different sizes of shafting.
8. They are the most thoroughly made wooden pulleys in the world.
9. And the handsomest pulley on the shaft.
10. No chances to take. Every pulley as represented or no sale.

Order a Sample Pulley, after which you will have no other.



EVERY PULLEY IS A SPLIT PULLEY
Made in any size from 9 inches to 16 ft. diameter with original bores of 3 and 3½ inches, bushings to be used for intermediate sizes; larger ones bored to order.

WE ALSO MANUFACTURE
WOODEN GROOVED PULLEYS FOR THE TRANSMISSION OF POWER
BY MANILLA ROPE,

Under the Dodge Patent System from 5 to 500 h. p. State power to be transmitted, speed of shafts, relative position of shafts, distance between shafts, and we can furnish a clear estimate.

EVERY PULLEY WILL FIT.
22 or more sizes of Shafting.
200 of our Pulleys and an assortment of bushings represent as many as 4,000 iron pulleys, a great advantage to dealers carrying stock.

Apply for particulars to **THE DODGE WOOD SPLIT PULLEY CO., TORONTO.**

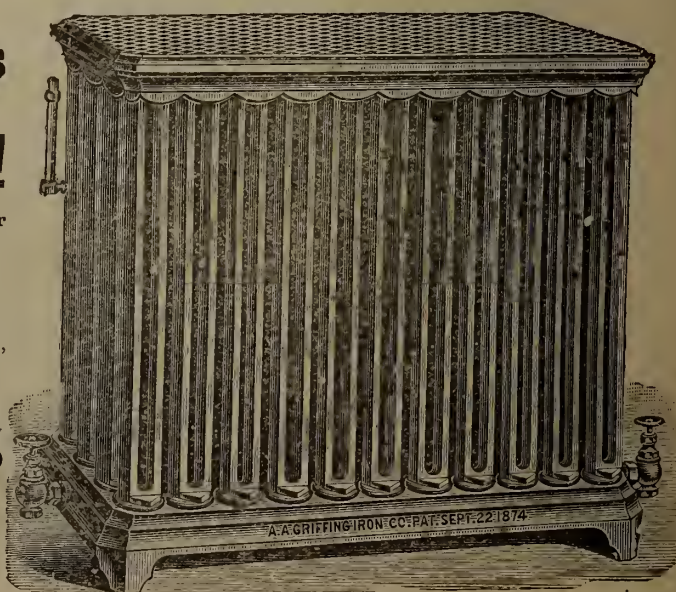
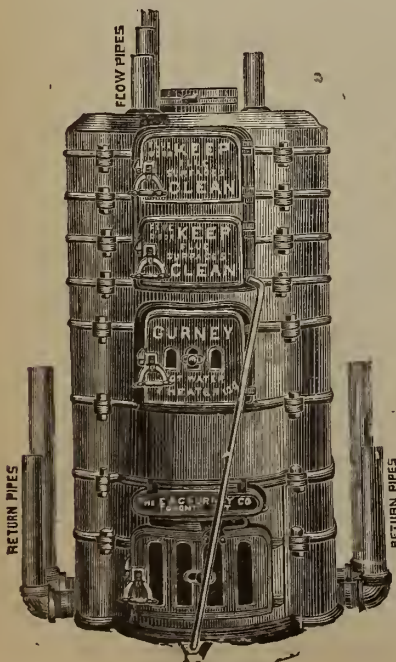
USE GURNEY'S IMPROVED CELEBRATED Hot Water Heaters!

Guaranteed more Economical than any other Heater now made, and containing every known Improvement in Hot Water Heating.

STEAM FITTINGS, CAST IRON PIPE,
REGISTER, GRATES, ETC.

HOT AIR FURNACES
FOR COAL OR WOOD.

E. & C. GURNEY & CO.,
MONTREAL.



Bundy Radiators for Quick Circulation and Economy of Space.

MAP

—OF THE—

PHOSPHATE REGION

—OF—

OTTAWA COUNTY, QUE.

This, the only Map of the Phosphate Region now extant, embraces the Townships of

BUCKINGHAM, HULL, PORTLAND (East and West), WAKEFIELD, TEMPLETON, DERRY, THE GORE OF TEMPLEYON, VILLENEUVE, &c.

The location of all mines now or lately in active operation are prominently delineated.

As only a few copies of this excellent Map remain unsold, orders should be sent in without delay.

PRICE, TWO DOLLARS.

On sale only at the offices of

THE CANADIAN MINING REVIEW,
OTTAWA.

THE DOMINION SAFETY BOILER CO.

MANUFACTURERS OF

The "Field-Stirling" Patent High Pressure Boiler,

The Safest and Cheapest Steam-Generator now in Use.

This Boiler is unusually durable, being made of the best steel and wrought iron exclusively. No cast-iron is employed. It is simple in construction, has a rapid, well-defined circulation, and a large cool mud-drum, where all impurities are collected to be blown off. All parts of the Boiler are readily accessible for the closest inspection. It has great excess of strength and is not liable to be strained by unequal expansion. The water space is divided into sections so arranged that NO EXPLOSION IS POSSIBLE.

Some of Our Leading Customers:

The J. A. Converse Mfg. Co. (A. W. Morris & Bro.), Montreal; The Canada Sugar Refining Co., Montreal; The Pillow and Hersey Mfg. Co., Montreal; The Berthier Beet Root Sugar Co., Berthier, Que.; The Imperial Insurance Co., Montreal; The Massey Manufacturing Co., Toronto; The Acadia Coal Co. (Ltd.), Stellarton, N.S.; Canada Paper Co., Windsor Mills, Que.; Royal Electric Co. (Central Station), Montreal; Dodge Wood Split Pulley Co., Toronto, and a repeat order from A. W. Morris & Bro., after five months' experience; Ingersoll Rock Drill Co. of Canada.

We guarantee Dry Steam and Great Economy of Fuel. Correspondence Solicited.

J. FRASER TORRANCE, M.E.,

P.O. Box 1707, Montreal.

Manager

Boiler For Sale.

AN EIGHTY H.P. TUBULAR STEEL BOILER made by W. C. White, Montreal, 15 ft. x 5 ft. 4 in. —eighty 3½ in. tubes; smoke stack 45 ft. long; guy-lards and guys. Very little used. Equal to new. Price on terms, \$600. Address

P. O. Box 6,
MONTREAL.

SHIPMAN ENGINES, ACME MODEL.

COAL OIL FOR FUEL.



To parties requiring a safe, reliable, durable and economical Steam Launch, from 20x4 to 35x7 with ample power to give satisfactory speed can supply the best on the market and at prices which will defy competition for a like quality of goods. We have a full staff of competent boat and engine builders and guarantee every article to be strictly first class. Hundreds of our engines from 1 to 12 h. p. Marine or Stationary have been in use for years and are acknowledged superior to all others. No smoke, dirt or sparks, no manual or mechanical labor necessary. You have the privacy of your launch for your family. As the water and oil supply is automatic very little attention is required. But a few minutes is necessary to get up 100 lbs. of steam; when you return to the boat house by turning a hand wheel all fire is extinguished. Orders for coming season should be placed at once, as the demand is much in excess of previous years. Write for 1889 circulars giving prices, testimonials, etc. No attention paid to postal cards.

JOHN GILLIES & CO., Carleton Place, Ont.



Mines, Elevators, Inclines, &c.

GALVANIZED GUY ROPE. BRIDGE CABLES.
HAWSER ROPES.

WIRE of all kinds. Insulated WIRES

John A. Roebling's Sons Co.

117 & 119 LIBERTY St., NEW YORK.

H. L SHIPPY Sec'y.

Victor Electric Fuses.

Superior to all others for Exploding any make of Dynamite, High Explosives, or Gelatine Powder. Each Fuse is tested and warranted extra strong and waterproof. Low grades of Dynamite Powder will do ten per cent. more execution if detonated with Victor Electric Fuses.

VICTOR BLASTING MACHINES.

Latest improvements, made in three sizes, easy to operate, strong and durable. No expensive repairs, low in price, will fire any make of Electric Fuses.

MANUFACTURED ONLY BY

JAMES MACBETH & CO.,

128 Maiden Lane, N.Y., U.S.A.

Send for Catalogue.

HARRIS & CAMPBELL

Latest Designs in Drawingroom, Diningroom and Bedroom

FURNITURE

With improved Steam Machinery our facilities for manufacturing Cabinet Goods are complete. Our upholstery Department is well stocked with latest imported patterns.

Corner QUEEN & O'CONNOR Sts
OTTAWA.

D. McEWEN & SON, Machine, Engine & Boiler Works

(Established January, 1868)

Compound and Yacht Engines a Specialty.
Estimates for Steamboats complete.

MINING REPAIRS CONSTANTLY ON HAND.

WORKS AND OFFICE:

54 to 60 Queen Street, Kingston, Ont.

WARMING,

STIMULATING,

STRENGTHENING,

INVIGORATING,

THESE ARE THE CHARACTERISTICS OF



THE MOST PERFECT FORM OF
CONCENTRATED FOOD.

If you want

BAGS

FOR PACKING

ASBESTOS, PHOSPHATES, ORES, &c.,
Send to us for Samples and Prices.

Every quality and size in stock.

Specially strong sewing for heavy materials.

Lowest prices compatible with good work.

We now supply most of the Mining Companies, and those who have not bought from us would find it to their advantage to do so.

THE CANADA JUTE COMPANY (LTD.)

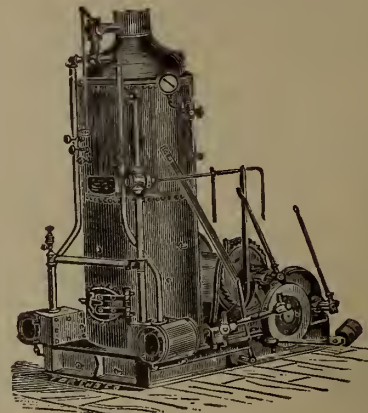
17, 19 & 21 ST. MARTIN STREET,

Established 1882.

MONTREAL.

M. BEATTY & SONS,

WELLAND, ONT.



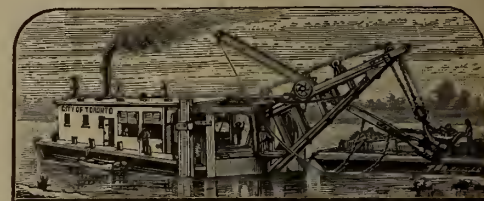
HOISTING
ENGINES

ENGINES
FOR
Mines
AND
Inclines

Horse-Power Hoisters,

Stone Derrick Irons,

Centrifugal Pumps



DREDGES,

DERRICKS,

STEAM SHOVELS,

And other Contractors' Plant.

AMALGAMATING MACHINERY.

Stamp Mills for Wet or Dry Crushing. Huntington Centrifugal Quartz Mill. Drying Cylinders. Amalgamating Pans. Settlers, Agitators and Concentrators. Retorts, Bullion and Ingot Moulds, Conveyors, Elevators, Bruckners and Howell's Improved White's Roasting Furnaces, Etc.

CONCENTRATING MACHINERY.

Blake, Dodge and Comet Crushers, Cornish Crushing and Finishing Rolls, Hartz Plunger and Collom Jigs. Frue Vanner & Embrey Concentrators, Evans', Calumet, Collom's and Rittenger's Slime Tables. Trommels, Wire Cloth and Punched Plates. Ore Sample Grinders and Hoherle Mills.

FRASER & CHALMERS, MINING * MACHINERY.

Improved Corliss and Slide-Valve Steam Engines,
Boilers--Horizontal, Vertical and Sectional,
IMPROVED STEAM STAMPS.

Hoisting Engines, Safety Cages,
Safety Hooks,
Ore Cars, Water and Ore Buckets,
Air Compressors, Rock Drills, Etc.
General Mill and Mining
Supplies, Etc.



Pumping Engines and Cornish
Pumping Machinery,
Improved Water Jacket
Blast Furnaces for Calena and
Copper Ores.
Slag Cars and Pots,
Rots & Baker Pressure Blowers,
Suspended Tramways.

Sectional Machinery for Mule-Back Transportation.

General Offices and Works: FULTON & UNION STS., CHICAGO, ILL.

BRANCH OFFICES: NEW YORK, Room 43, No. 2 Wall St. DENVER, COLO., 1316 Eighteenth St. SALT LAKE CITY, UTAH, 7 West Second South St. LONDON, ENGLAND, 23 Bucklersbury, E. C. CHIHUAHUA CITY, MEXICO, No. 11 Calle de Juarez. LIMA, PERU, South America. JOHANNESBURG, TRANSVAAL, South Africa.

Sole Western Agents for TYLER WIRE WORKS Double Crimped Mining Cloths.

The Canadian Mining Review

CONDUCTED BY B. T. A. BELL

OFFICES:

UNION CHAMBERS, 14 Metcalfe St.
OTTAWA.

Vol. VIII. NOVEMBER, 1889. No. 11.

Geological Survey of Nova Scotia.

It is rumored that the authorities of the Geological Survey will issue the geological map of Nova Scotia upon the reduced scale of four miles to the inch. It is difficult to see the object of the Survey in thus reducing the scale, for the field work and original plotting have been done upon a scale of one mile to the inch, and the proposed change means a great deal of labor for the draughtsmen of the department, and a consequent delay in the issuing of the map. Moreover the map of Cape Breton made by Mr. Hugh Fletcher, and already published is on the scale of one mile to the inch, and is as beautiful and admirable a piece of work as one could desire, and has done a great deal to keep up and sustain the reputation of the Survey. To publish the map of the rest of Nova Scotia upon a reduced scale would be a great mistake in our judgment, and would mar the beauty and utility of the work already published.

The utility of a geological survey depends largely upon its ability to help the instruction of the people in the application of science to the enlargement of their practical knowledge, and consequent increase of their material and national prosperity. Not a small part of the development of the natural resources of our neighbors across the line, particularly of the Eastern States, has come from the various State Geological Surveys which have been going on more or less for the past fifty years.

Nova Scotia has been, and is to-day, whatever the future may bring forth, the foremost province of the Dominion in the matter of mineral development, and no parsimonious spirit should actuate the Government in carrying forward upon the same liberal scale the work of the local staff of the Geological Survey. To stultify or embarrass in great measure the admirable work which has already been done and is doing by such a reduction as we have indicated would be a piece of penny wisdom and pound folly.

The Future of Phosphate.

In the inaugural address of the President of the Ottawa Literary and Scientific Society on the 14th instant, Mr. H. B. Small, whilst treating of development and progress alluded to the exhaustion of the soil by repeated cropping without restoring artificially the mineral waste annually taken out in grain. He quoted from a statement made by Mr. Gordon Brown in 1869 that the shipments of grain in that year from the port of Montreal contained 2,340 tons

of phosphoric acid, and that to have restored that to the surface of country represented in the shipments 5,850 tons of apatite would have been required. On this point Mr. Small said: "This again leads to development; our new phosphate industry, the product of which is not yet used at home, is in constantly increasing demand abroad, and when its necessity becomes apparent here, such a development will take place around the scene of production as will wake the echoes of the old Laurentian hills, and imagination would not be far astray in picturing at our Chaudière water-power large manufacturing establishments for grinding, treating and manipulating this necessary adjunct to wheat growth, long after the present lumber business is removed to points nearer its supply."

Government Aid to Mining.

Halifax, 20th Nov., 1889.

The Editor:

In countries where a royalty, duty or other tax is imposed by the Government upon the precious metals mined therein, it is usual to find governmental aid to such mining industries in some form or other. This aid is always in the direction of keeping alive, fostering, and building up such industries, not only on account of the intrinsic value of the production, but chiefly on account of their value in building up the country, and in increasing the aggregate of the national wealth. In Canada the chief mining province, Nova Scotia, is burdened in the matter of royalties, but, strange to say, has not recompense in the way of government aid. The contrast in this matter between the Governments of Victoria, New South Wales, New Zealand (and in fact all the Australian colonies) and that of Nova Scotia, is most striking.

For many years now it has been a well defined and well executed policy of the Australian Government to foster and stimulate the mining industries of the colonies by the granting of subsidies to deep mining; by the construction and maintenance of good roads to the various mining districts; by the building of water ways, sluices and tramroads, from which by tolls and rents an equitable rate of interest on the investment is secured; by the construction of test metallurgical establishments where lots up to ten tons in weight may be tested and the best metallurgical method of reduction secured under competent advice; by the establishment of "National Schools of Mines;" by the inauguration of a kind of peripatetic school, in which competent men travel from one mining district to another, to instruct, during six or eight weeks in each district, such workmen as desire, in the studies of assaying, mineralogy, geology and mining; and by sundry and various other ways give knowledge, aid and encouragement to that industry to which is due, more than to any other, the national prosperity and wealth. For these and kindred objects

over \$400,000 are annually spent by the colony of Victoria alone.

With natural mineral resources full as varied, and less only in degree, certainly not in kind, Nova Scotia presents the contrast of masterly inactivity, and miserly parsimony. Here, apparently all the energies of the Department of Mines are spent in eagerly taking in the rents and royalties which are yearly and constantly growing in amount. With the exception of the rule or order giving aid to gold district roads (by granting from the Provincial Treasury two dollars for every one dollar paid by the district), and the recent Act relating to "Schools of Instruction for Miners," absolutely nothing has been done to encourage and help the industry from which the Province draws its principal item of income. The Miners' School Act, moreover, is only tentative, and is limited and free only to such of the coal miners as desire to go up for examination as overmen or underground managers.

As the Department is at present organized, the only officer who is in a position to ascertain the needs, and to promulgate and carry forward any scheme for aid is the Inspector, who, by law (Chap. 7, Sec. 5, R.S., Nova Scotia), is supposed to be a professional mining engineer, and is required to see that mines under lease from the Crown "are being worked in a scientific, workmanlike and effective manner." The gentleman now holding the office of Inspector has the requisite qualifications and ability, but, unfortunately for the mining industry, the Government in a spasmodic attempt at economy, some two or three years ago, united the offices of Deputy Commissioner and one person is now supposed to perform the duties of the dual office. However able and conscientious the incumbent may be, it is simply impossible that any one man should perform the respective duties of Deputy and Inspector and do justice to both; the duties of the two offices are largely of a different character, and call for a different order of ability in administration.

Were the Inspector freed from the petty details and time exacting duties of the Deputy Commissionership, it would afford time and opportunity for the doing of much good and the giving of much help in a judicious and authoritative way; e.g. by condemning obsolete and extravagant devices and methods; by discouraging the expenditure of large sums upon improved properties; by encouraging and promulgating sound principles and systems of mining, and known and tested methods of milling and reduction; and in general, by frequent visits to the mining camps to unite the confidence and consultation of the men in charge of the mining industries. And in this connection it may be said that advice coming in such a way, from an authoritative source, is always well pondered over and considered, if not followed: but the practice which seemed to obtain last year, of sending to certain gold districts, an irresponsible

person, having no knowledge of the mining business, either by training or by practice, and who has not the confidence of the mining managers, but whom on the contrary they know to be a novice, should be condemned. Mining men are very receptive of ideas, and, as a rule, eager to learn: but they are very quick to detect incompetency, and to reject what they believe to be unreliable.

Among the few good ideas which have been advocated as government measures, none are so promising as the Assay Office scheme which was elaborated by the Gold Miner's Association of Nova Scotia, last winter. This was a first step and a most important one toward the beginning of a new era in the gold mining industry. Where else in the world can be found a country producing precious metals to the extent of Nova Scotia with not a single assay office in the Province? It will seem incredible to other gold producing countries. We sincerely hope that the Assay Office scheme will not be allowed to drop, but will be taken up again at the coming sessions of both the Dominion and Provincial assemblies.

The idea of the government subsidizing deep mining is also excellent, but is surrounded with many pit-falls, and will need great care in working out. Any aid of this nature must be applicable to any and all of the different gold mining districts of the Province, and it is worth considering whether the aid afforded by the government should not rather be of the nature of a bonus, say a bonus of a fixed sum for each shaft attaining a depth of 1000 feet, of another fixed sum for each shaft attaining a depth of 1500 feet, and for another fixed sum for 2000 feet or over. Another consideration may be whether a rebate of royalties, in a fixed ratio for the depths attained, would not be wider reaching in its benefits.

It is certainly time that Nova Scotia was aroused to a sense of its shortcomings in this matter, and that the mining industries of that Province should receive the encouragement and aid to which they are justly entitled.

I am, etc,
GOLD MINER.

Phosphate Analyses.

Montreal, Nov. 17, 1889.

The Editor:

SIR,—Some comment having been made upon my remarks, at the Meeting of the American Institute of Mining Engineers, at Ottawa, with reference to the system of selling Canadian phosphate abroad, I ask your kind permission to give some further facts bearing upon this subject, which is one of vital importance to the Canadian phosphate industry.

The encouragement of mining of course depends upon its financial results, and no work will be long carried on unless it is profitable. The nominal prices for phosphate in Europe have tempted many persons to undertake its

production, but the returns have been so much less than was expected that the effort, after one attempt, has in many cases been abandoned, and a number of properties that are capable of profitable working have been consigned to idleness.

The first disappointment in the account sales was the discovery that a discount of $2\frac{1}{2}$ per cent. was taken off the nominal price. Next it was observed that the weight of the phosphate as ascertained upon discharge from the ship, was reduced by a deduction of the moisture expelled by drying a sample of the ore at a temperature of 212° . This deduction often amounted to three or four per cent., and in many cases was taken, not from the weight, but from the percentage of phosphate of lime, thus occasioning a further loss of 2 or 3 per cent. a ton. Then the quality was found to be much lower than it had been estimated by Canadian analysts. The chemists had differed over three per cent., so a third one was called in who agreed with the lowest, and the average of all the tests brought the result perhaps one per cent. below the guaranteed quality. The phosphate having been delivered to the buyer, the seller was now completely at his mercy, and instead of a settlement at the usual market rate of one fifth of a penny a unit, the buyer gave the alternative of taking the phosphate away or accepting a reduction greatly in excess of the usual sliding scale. The net proceeds failed to cover the cost of production, and mining was discontinued.

Many of your readers in Ottawa County will say, "that was just my experience!" In fact, Mr. Editor, "we have all been there," and some of us have been there so often that we are at last determined to do something about it, and if possible put a stop to what is nothing less than a commercial scandal.

In addition to the objectionable system of guarantees and the absurd practice of delivering goods to the buyer before their value is determined, there is ground for suspicion that in some cases the sampling is not fairly done, and that the remark of an agent, "a five pound note will go a long way," is not wholly unwarranted. The fact also remains that the analysis of the buyer's chemist is in a majority of cases lower than that of the seller's chemist, and, as I have stated, was so in one season's shipments in seven cases out of eight, and the differences have been sometimes as high as $3\frac{1}{2}$ per cent.

A few experiences that can be verified, if called in question, will show what has been suffered by Canadian sellers of phosphate in Europe. A cargo was forwarded by rail to Oldham, near Birmingham. It was sold at 1s 2d for 75 per cent., with $\frac{1}{2}$ d. per unit rise. Careful sampling and analysis in Canada made it 75 per cent. The result of the English sampling and analysis was 72 per cent. The trade reduction would have been $\frac{3}{4}$ of a penny, making the price 1s $1\frac{3}{4}$ d per unit, or 80s 5d per ton. But the market having fallen, and the cost of removal being heavy, the buyers succeeded in forcing a settlement at 10 $\frac{1}{2}$ d per unit, or 63s per ton, taking an advantage of 17s 5d per ton beyond the usual allowance.

A cargo guaranteed 70 per cent., and analyzed over that in Canada, was transhipped to an outport from London. The seller's chemist made it 71, the buyer's made it 68, the referee made it 67. The lot was rejected, and rather than let the buyer have it at slaughter prices it was taken back to London and shipped to the Continent, the expenses entailing a heavy loss.

A cargo shipped to Stockholm went two per cent. below guarantee. Exorbitant demands being made, it was taken to Hamburg, and

freight and expenses nearly ate up the whole venture.

In one case this season where a cargo went only two per cent. below guarantee, a demand for a reduction of £1 10s per ton was made, though the trade allowance would have been 13s per ton. In another case, rather than yield to an exorbitant demand, where there was a falling short of only two per cent., the lot was taken away at a loss of £1 per ton to the seller.

Cases could be multiplied far beyond the limits of your space and the patience of your readers. These are enough to show the grievance; and now let us consider the remedy.

Methods of sampling that admit of no partiality must be insisted on. The chemists must be urged to adopt uniform methods of analysis. Sellers must resist the demand for deducting the moisture from the percentage of quality. Above all, the sale upon absolute guarantee must be refused, and the sliding scale of price must work equally up or down, or at most $\frac{1}{2}$ d up and $\frac{1}{4}$ d down. But it will be said that buyers must have some assurance as to what quality they are to receive. To meet this reasonable requirement a sample should be taken and an analysis made before shipment by some person recognized as an authority by the buyers and sellers, and this should determine the classification for shipping purposes, no further guarantee being given; but the settlement of value would be made as now upon the foreign sampling and analysis. The sampling should be done by one impartial person instead of making it a contest of wits between two parties, each bent upon taking advantage of the other.

Efforts have been made by sellers in the past to secure these concessions, but the volume of Canadian export has been too small, and there has been too little harmony among producers to permit the dictation of selling terms. Now that Canadian phosphate has won its way in the market, and the raisers, it is to be hoped, have learned the lesson of union and friendly combination that is being exemplified in all successful industries, the time has come to put an end to the remediable ills from which the phosphate trade has so long suffered with a patience that is not to its credit.

The first thing to be done is to refuse to sell on absolute guarantees of high quality with privilege of rejection. The Carolina phosphate is quite uniform in quality, and there is but little risk in a guarantee of 55 per cent. Put although the pure Canadian apatite always contains from 85 to 92 per cent. of phosphate of lime, the quality of a shipment depends upon the amount of other rock that has been allowed to mix with the apatite. This it is very difficult to determine, and the sampling of Canadian phosphate must be always something of a lottery until it is sold in a pulverized condition. It is this very uncertainty that has made the buyers strenuous for high guarantees, for they have learned that there is a chance that a good lot will go under test and may be rejected and brought in at a great reduction.

The remedy, then, for the chief evil of the trade, the rejection of goods after they are in the buyer's hands, is this—the united resolution of sellers to sell on the statement of quality by a recognized authority, but without guarantee. Union and conference will also determine means of obviating other disadvantages. Phosphate is constantly assuming increased importance as an article of commerce, and the future of its producers is a bright one if they will use their intelligence to secure fair play.

ROBERT C. ADAMS.

Possibilities of Iron Manufacture At Ottawa.

By John Birkinbine, Philadelphia, Pa.

The unsatisfactory results which have followed some of the attempts to produce and manufacture iron in the Dominion of Canada, and the failure of capitalists to take advantage of the bonus offered by Parliament, have combined to encourage a degree of distrust in Canadian ventures which seems scarcely warranted by existing conditions.

In a paper presented by Mr. J. H. Bartlett, of Montreal, at the Halifax meeting of the American Institute of Mining Engineers, the various attempts to manufacture iron in Canada were reviewed, and the possibility of achieving success strongly presented. Mr. Bartlett justly claims that much of the discredit which has come upon investments in the production or manufacture of iron in the Dominion is due to the facility with which money was placed in so-called "improved processes," heralded as short cuts to metallurgical success. He also asserts that "the only attempt ever made to manufacture coke pig-iron and refined bar-iron has proved the possibility of so doing."

The small output of Canadian pig iron, which has been mostly produced from bog-ores with charcoal as fuel, does not give promise of extension, for although these ores are abundant, they are lean and hydrated, requiring the mining of large quantities of ore and the rapid denudation of convenient timber on account of the consumption of ore and charcoal per ton of product. The future of the Canadian iron industry would appear to be dependent upon the magnetic and red hematite ores more than upon the leaner bog-ores, although the latter may form an important factor in mixtures. The abundance of timber promises a supply of charcoal for an industry of considerable dimensions, but wood is constantly appreciating in value for other purposes, and although there is a large field for the manufacture of iron with charcoal, the bulk of the iron produced will most probably be smelted with mineral fuel. Coal is found in the eastern provinces and also in the western section of the Dominion, there is no apparent supply of domestic mineral fuel within 700 miles of Ottawa.

A critical examination of a number of iron-ore deposits convenient to Ottawa, encouraged the presentation of a discussion upon the possibilities for producing pig-iron offered by the Capital or its vicinity, as a basis for determining the practicabilities offered by the Dominion for iron production and manufacture. At the outset it may be noted that within six miles of the parliament buildings, portions of a blast-furnace are now standing, the plant having been constructed to smelt the local magnetites with charcoal, and within eleven miles there are the ruins of a forge and charcoal kilns, part of a plant where blooms were produced from ore by the direct or Catalan process, neither of these have been active in late years.

In the production of iron the first desideratum is the ore supply, and omitting further notice of the bog ore deposits in Quebec or the large exploitations which have attracted attention and capital in the vicinity of Hastings, Ontario; attention will be directed to some deposits which are more directly tributary to Ottawa and from which various mixtures could be made. Some of these were mentioned in a paper by Mr. Fred. P. Dewey,* Curator of the National Museum, at Washington, and all of

them are referred to in Prof. Harrington's monograph, upon the economic minerals of the Dominion of Canada.

These ore-deposits which have been personally examined are:

A. In the Province of Quebec at Hull, six miles, and at the Haycock Location, eleven miles north of Ottawa. As Hull mining has been prosecuted to a considerable extent and large quantities of ore removed, some of which was smelted in the blast-furnace above referred to prior to its partial destruction by fire, but most of it was shipped to the United States prior to the assessment of the customs duty of 75 cents per ton. This ore was carried by rail to the St. Lawrence River on Lake Ontario for 50 cents per ton, and from the Canadian ports to Cleveland the freight was 75 cents per ton. A royalty of \$1 per ton was also paid to the owners.

At the Haycock location and at adjacent properties the exposure is such as to offer impressive surface indications, but although some of the mineral was worked into blooms in the forge mentioned, the operations were not sufficiently extensive to develop the properties or to prove their commercial value. This ore is mostly specular; and may develop into an important deposit.

The following analyses were taken from the Canadian Geological Survey:

	Haycock.		Hull Red Ore.	Black Ore.
	1	2	3	4
Ferric oxide.....	88.08	85.45	66.20	73.90
Ferrous oxide.....	6.86	5.24	17.78	
Manganous oxide..	0.24	0.15	trace.	none.
Alumina				0.61
Lime	0.55	0.41	1.85	
Magnesia.....	0.13	0.17	0.18	1.88
Phosphoric acid...	0.16	0.13		
Phosphorus			0.015	0.027
Sulphur	0.03	0.07	0.28	0.085
Silica			11.11	20.27
Titanic acid	3.17	2.12	none.	none.
Carbon	0.35	0.28		
Carbonic acid.....			1.17	
Graphite			0.71	
Water				3.27
Insoluble.....	0.26	5.77		
	99.83	99.79	99.295	100.042
Iron	66.98	63.88	60.17	53.51

1 and 2 by Prof. E. J. Chapman.

3 and 4 by Dr. J. S. Hunt.

B. The Bristol mines in Pontiac County, Province of Quebec, are connected by railroad with Ottawa, 35 miles distant, and present very favorable evidences of a deposit of magnitude from which over 10,000 tons of ore have been won. Some 4,000 tons of this ore were shipped to and smelted in the Charlotte furnace in New York. The ore is a rich, dense magnetite, unusually low in phosphorus, but carrying sulphur in such quantity as to require roasting, for which the property is admirably equipped. There are now in place two Taylor Langdon roasters, and one Westman kiln, modified by Mr. Ernest Sjosdelt, resembling in many points what is known as the Davis Kolby kiln. These kilns are operated by gas generated in Langdon producers. The mine has been opened to a depth of 150 feet, with drifts along the strike of 150 feet and across the vein of 50 feet in one place and 30 feet and 60 feet in length in another locality, while test-pits and magnetic surveys indicate a deposit of considerable magnitude. The following analyses show the composition of this ore, both raw and calcined:

	RAW.			
	A.	B.	C.	
Iron.....	58.37	62.15	61.987	
Sulphur.....	1.46	0.97	2.406	
Phosphorus.....	trace.	.0075	.006	
Silica.....	11.45	8.52	7.32	
Lime.....	3.91			

ROASTED.

	D.	E.	F.	G.
Iron.....	62.5	62.525	62.87	63.24
Sulphur.....	0.521	1.1673	2.221	1.08
Phosphorus.....	.004		0.014	
Silica.....				
Lime.....				

A. Geological Survey of Canada.

B. R. Richards, Boston.

C. Pooth, Garrett & Blair.

D. Lackawanna Iron and Coal Co.

E. McGill, Ottawa.

F. G. Troy Iron and Steel Co.

The latest experiments with the roasters show, according to Mr. McGill's analyses, that the sulphur was reduced to 0.279.

C. In Lanark and Renfrew counties, Ontario 30 miles west of Ottawa, there are some favorable exposures of hematite and magnetic ores, samples taken from exploration shafts or outcrops analyzed as follows:

	Magnetite.	Hematite.
Iron.....	65.31	66.00
Phosphorus.....	0.017	0.06

The location of these ores, while convenient to Ottawa, is such as to facilitate their smelting with charcoal, for they occur in a well-timbered district, in which hard woods predominate.

D. Still further west in Ontario, on the line of the Kingston and Pembroke Railroad, are deposits of magnetite, which have been wrought considerably; such as those at Calabogie Lake and at Wilbur mine. The latter was operated by the Bethlehem Iron Company of Pennsylvania, and considerable ore was shipped to the furnaces of that company at Bethlehem. These ores could also be made accessible to a smelting plant at Ottawa, and lately considerable exploring work has been done in the vicinity of these operations by parties from the United States.

Analyses of some of these ores are presented by Mr. Dewey in the paper above referred to; they show from 57 to 65 per cent. of iron, with phosphorus generally below the Bessemer limit, and none of the determinations give over 4 per cent. of sulphur. Titanium, when present at all, is, according to the analyses, not over 1 per cent.

There are some hematite ores in the vicinity of Ottawa, but most of the development has been in the deposits of magnetite, and those nearest the city are generally sulphurous; a characteristic which should not necessarily condemn them, in view of the facts that over 1,000,000 tons of sulphurous magnetites are annually smelted in the United States, and that some of the American furnaces which have been most successful financially have used entirely or largely such ores.

Blast-furnace practice has demonstrated that it is difficult to produce good foundry grades of pig-iron with dense magnetites, particularly if they carry considerable sulphur; but modern plants, improved method and chemical research have done much to remove these troubles, and it is not prophesy to state that with a well-equipped and properly managed plant, using thoroughly roasted magnetites instead of ore partially calcined, satisfactory work in this particular can be obtained.* *

There seems, therefore, ample ground for relying upon the possibility of assembling a satisfactory supply of ores at or near Ottawa for the maintenance of a smelting-plant.

The limestone which abounds in the vicinity of Ottawa, and which forms the barrier through which the Ottawa River breaks in creating the Chaudiere Falls, furnishes ample flux. This stone is largely magnesian, but officers of the Geological Survey state that it can be obtained

* Vide Transactions, American Institute Mining Engineers, Vol. XII., page 192.

as nearly pure carbonate of lime or with varying proportions of lime or magnesia, and the flux can therefore be readily supplied.

The key to the problem would appear to be that of fuel. The Canadian customs protect its domestic bituminous mines by imposing a duty of 60 cents per ton on bituminous coal or coke made from it, but anthracite coal is admitted free of duty. Notwithstanding the tariff levied on foreign bituminous coal, the supply for the Province of Ontario comes principally from the United States. Last year over 2,000,000 tons of anthracite coal from Pennsylvania were consumed in the Dominion, and in addition 1,250,000 of bituminous coal from the United States paid a duty of 60 cents per ton.

The consumption of anthracite is not surprising when we remember that Scranton, the centre of the Lackawanna coal district of Pennsylvania is no farther from Ottawa, in a direct line, than it is from Rouse's Point, N.Y.; Portsmouth, N.H., or Cleveland, Ohio.

Independently of the customs duty, Ottawa is as favorably located for obtaining a supply of Connellsville coke, as the blast-furnaces on Lake Champlain, or those at Chicago; and under favorable railroad rates the cost of coke furnished in large quantities from the Connellsville district at Ottawa should be practically the cost at Chicago plus the duty of 60 cents per ton. The distances from Ottawa to Connellsville, Pa., and to the boundary of the Province of New Brunswick, are practically equal.

If, however, coke made from coal obtained in some of the northern counties of Pennsylvania is brought to Ottawa, there would be a difference in distance of about 100 miles in favor of Ottawa, as compared with Chicago, to offset the duty.

Whether a supply of coke would come from the Connellsville district, or from some of the more northern Pennsylvania plants which now produce very satisfactory coke for iron smelting, or whether it would be brought from the eastern provinces of the Dominion, would be determined by a full consideration of the subject from a commercial basis when contracts were to be let; but to place the problem on a perfectly equitable footing, we may take the price of coke at Connellsville at \$1.50 per ton; add transportation equivalent to the freight from Connellsville to Chicago, \$2.75 per ton, add for duty 60 cents per ton, making a total of \$4.85 per ton. Allow for less favorable freight rates to Ottawa than given to Chicago, we may add 25 cents per ton; making coke at Ottawa cost \$5.10. Therefore, if Connellsville coke costs this amount at Ottawa, a comparison can be made with the cost of that produced in the eastern provinces, or obtained from points in Pennsylvania 100 miles nearer Ottawa than Connellsville.

Anthracite coal can now be delivered at the furnaces on Lake Champlain for \$4.25 per gross ton, and an allowance of \$5.00 per ton at Ottawa would therefore appear to be sufficient. Whether a mixture of anthracite coal and coke would be most advantageous, or what that mixture would be, can only be decided upon actual contract quotations; but from the above figures an allowance of \$6.50 for the fuel to produce a ton of pig-iron at Ottawa would appear to be conservative.

To obtain an estimate of the cost of material used in the production of the metal, we may assume that the ore from the Bristol mines is used, as the development of this property, its roasting equipment and the indications of a large deposit existing, offer the most satisfactory conditions for immediate utilization, while its

distance from Ottawa (35 miles) is such as will embrace other ore deposits, which have been referred to, some of which will not require roasting to eliminate sulphur, and others may be used as mixtures. To allow liberally, the cost may be taken of the

	Per ton.
Raw ore at the mines at.....	\$1.40
Add roasting and loss .....	.60
Freight to Ottawa.....	.55

Cost of 1 ton of ore..... \$2.55

As this roasted ore will yield 60 per cent. of iron, or more, the cost of ore for a ton of pig-iron will be: $1\frac{2}{3}$ tons at \$2.55 equals \$4.25. The convenience of fluxing material will make this item small, and an allowance of 50 cents per ton of iron made should be ample. The materials for producing a ton of pig-iron may therefore be summarized as:

Fuel.....	\$6.50
Ore.....	4.25
Flux.....	.50
	\$11.25

To which may be added for labor, repairs, office expenses, supplies, incidentals, depreciation, etc., say..... 2.75

Making a ton of pig-iron cost..... \$14.00

A figure possibly above what practical operation may demonstrate as the actual outlay, but still sufficiently low to encourage operations which will displace at least a part of the 50,000 tons of pig-iron annually imported into the Dominion, or furnish material which may be utilized to produce a portion of the 250,000 tons of manufactured cast- and wrought-iron which enter Canada each year.

That a possible market for the product of a number of furnaces exists in the Dominion needs no exemplification to those who are at all familiar with its territory and its people. But the question naturally arises, can pig-iron be produced in the Dominion to compete with foreign metal?

In this estimate the locality for the smelting of the ores is near the vicinity of Ottawa. There may be other points apparently even more favourably situated, and in that case comparative figures can be readily made. Similarly the ore from the Bristol mines is used as a basis for estimating, because of its convenience to Ottawa, its condition for immediate utilization and the known composition of its product. If ores from other localities are preferable, or if they are to be used as mixtures, proper allowances can be made. We may therefore use the figures of estimated cost herein given as a basis for determining what chances Canadian pig-iron has in competition with foreign iron.

The Canadian duty is now \$4.00 per net ton on pig-iron—the estimated cost above is per gross ton. In addition, the government offer a bonus of \$1.00 per net ton on all pig-iron made in Canada from Canadian ores, therefore the domestic metal would be protected, at least until the expiration of the bounty period, to the extent of \$5.00 per net ton, or about \$5.60 per gross ton.

If now, pig-iron made at Ottawa costs \$14.00 per ton, foreign metal would have to be delivered there at \$8.40 per ton to meet this cost. But an allowance for profit must be made; including this, as well as the percentage of loss from bad debts, and also adding liberally for possible discrepancies in the estimate, say \$2.60, the domestic product could meet foreign iron delivered at Ottawa at \$11.00 per ton. As the iron is shipped away from Ottawa freights must be added, but there still seems to be ample margin to encourage the production of domestic pig-iron in Canada.

The estimates offered are for the production of pig-iron, using anthracite coal, coke, or a mixture of these two fuels, but the subject should not be dismissed without considering the possibility of employing charcoal as fuel, and considerable discussion has, from time to time, been had upon the utilization of the enormous waste from the mills at Ottawa, by converting it into charcoal. The slabs and larger refuse could be charred in kilns, but most of the timber now used in the mills is of a character producing charcoal of inferior quality for blast-furnace use. Improvements in manufacture are also utilizing much of the waste for special products, which reduce the chances of a permanent supply for this purpose.

There seems to be more encouragement to convert the saw-mill refuse and saw-dust into gaseous fuel, as in Sweden, and use it for manufacturing iron and other metallurgical purposes. Gas producers for this purpose would have to be equipped with condensers, for the refuse material supplied to the producers would carry 40 per cent. or more of water.

If pig-iron is produced in the vicinity of Ottawa, there would seem to be good encouragement for investigating the economical employment of this waste material, and also the possible utilization of some of the water-power available in the vicinity.

As noted before, the production of charcoal pig iron apparently offers greater advantages at some of the localities where the ores and hardwood timber are contiguous. The charcoal required for smelting a ton of pig iron would probably cost from \$7 to \$8 at Ottawa, from \$1 to \$2 in excess of the cost at the other points indicated. As this charcoal-iron would be used for special purposes, it should command a corresponding price in the market.

Record of a Charcoal Blast Furnace.—

While 85 tons of pig iron in 24 hours has been the greatest outturn of a charcoal furnace yet recorded, the Hinkle blast furnace, at Ashland, Wisconsin, has made as much as 112 tons in the same time. The furnace stack is 60 feet high and 12 feet in diameter at the boshes. Four casts are made daily, and each cast covers considerably more than half the floor of the casting-house. The outturn of the furnace during the month of March, 1889, amounted to 3,004 tons of pig iron. It is thus evident that at least one charcoal furnace, in point of improvement, is keeping pace with the coke furnaces.

The Gaspé Oil Wells.—

Considerable excitement is reported from Gaspé, on the south shore of the Gulf of St. Lawrence, in consequence of the extensive preparations now going on for the development of the oil deposits there. Indications of petroleum were found there eighteen years ago, it is stated, and a company was in process of formation for the purpose of boring, when the men interested in the scheme were attracted to Pennsylvania by the immense yield of oil there reported. Col. James Foley, of Boston, representing a company of American capitalists, has now arrived at Gaspé with extensive machinery and a strong force of engineers, derrick builders, etc., and is hurrying forward preparations for sinking a couple of wells to a depth of 2,500 feet each. The company represented by the Colonel, it is reported, has acquired a large area of the land covering the Gaspé deposits.

PHOSPHATE.

In General.

A strong company, with a capital of \$1,200,000, has been formed to work an extensive deposit of phosphatic marl, containing, it is said, 75 per cent. of phosphate of lime in Florida. The property consists of 13,000 acres along the Withlacoochie River, near Dunellan in Marion and Cibiris Counties.

In round figures Great Britain annually consumes:—phosphates imported 270,000 tons; coprolites (home production) 20,000 tons; bone, animal charcoal, bone ash, imported 50,000; bones, home production say 60,000 tons, in all about 400,000 tons of fertilizing material.

Great Britain, it is estimated, has imported during a period of nine years ending 1887, about 1,030,842 tons of South Carolina phosphates. The demand for these phosphates in the United States increases rapidly from year to year thus reducing their exportation abroad, and English manufacturers are now looking to other sources for their future supplies. In this connection it is very gratifying to find that the extensive areas of Canadian phosphate are now rapidly gaining in favor.

Mons Graudean recently estimated that one year's crop in France represents 298,700 tons of phosphoric acid, of which only 151,200 tons of phosphoric acid were recovered in the stable dung, thus leaving a deficit of 147,000 tons of phosphoric acid, equal to over one million tons of superphosphate, to be made good by other means. The same authority also estimated that the entire number of farm animals in France in 1882, representing a live weight of 6,240,430 tons, had accumulated from their food 193,453 tons of mineral matter, containing 76,820 tons of phosphoric acid. These figures give some idea of the enormous quantities of phosphoric acid required to restore to the soil what is continually being carried away by the crops sold off the farm.

Markets.

Latest advices quote a good market in Britain for Canadian phosphate @ 1 1/2 d. for 80% and 10 1/2 d. for 75%. A prominent exporter has shewn us a letter in which it was stated that contracts for next season are now being made at a still greater advance on current quotations.

Shipments.

A prominent shipper writes: "Owing to the scarcity of freight room, and the London Strike which retained some of our steamships on the other side for six weeks and subsequently blocked the railways with freight so that we could not even obtain cars at Buckingham, a great deal of Canadian phosphate has been left over that should have gone forward this year. We have over 40 carloads here in Montreal which should have gone forward; all our bins at Buckingham are full, while large quantities are lying at East Templeton, Perth and Kingston. All the other miners and shippers are in the same position."

It is estimated that all the phosphate held over until next year will exceed 5,000 tons.

Great Britain is estimated to have imported during the nine years ending 1887 about 1,030,

842 tons of South Carolina phosphates. The home consumption of these phosphates is, however, increasing yearly, and British manufacturers are now looking to other sources for their future supplies. Canadian phosphates, we are glad to say, are steadily gaining in confidence on the other side, and there is every indication at present, that considerable capital will soon be forthcoming for their further development.

Shipments, 1889.

The following is a statement of the shipments of Canadian phosphate from the Port of Montreal, to date:

Date.	Vessel.	Destination.	Shipper.	Tons.
April 30	S.S. Lake Nepigon	Liverpool...	Lomer, Rohr & Co	240
May 13	" Toronto	" "	Anglo-Can. Ph Co	350
" 13	" Lake Winnipeg	" "	Lomer, Rohr & Co	95
" 15	" Colina	Glasgow...	Wilson & Green.	22
" 17	" Loch Lomond	London...	Lomer, Rohr & Co	567
" 20	" Oxenholme	Liverpool...	Wilson & Green.	360
" 20	" Fremona	London...	Millar & Co.	375
" 22	" Alcides	Glasgow...	Lomer, Rohr & Co	400
" 22	" Montreal	Liverpool...	" "	338
" 23	" Castellano	" "	" "	600
" 27	" Lake Ontario	" "	" "	300
" 27	" Henri IV	" "	" "	150
June 1	" Canopus	" "	Wilson & Green.	300
" 1	" "	" "	Lomer, Rohr & Co	100
" 1	" Kehrweider	Hamburg...	Wilson & Green.	251
" 5	" Circe	Glasgow...	Lomer, Rohr & Co	400
" 5	" Michigan	London...	" "	180
" 10	" Lake Superior	Liverpool...	" "	180
" 10	" Ripon City	Hull...	Millar & Co.	260
" 11	" Oregon	Liverpool...	Lomer, Rohr & Co	100
" 18	" Saturnine	" "	Wilson & Green.	401
" 18	" "	" "	Lomer, Rohr & Co	150
" 21	" Zambesi	" "	Millar & Co.	300
" 21	" "	" "	Lomer, Rohr & Co	100
" 25	" Montreal	" "	" "	270
" 29	" Lake Ontario	" "	" "	200
July 5	" Fremona	London...	" "	600
" 5	" Colina	Glasgow...	Wilson & Green.	134
" 5	" Ve-ta	Liverpool...	Lomer, Rohr & Co	160
" 5	" "	" "	Wilson & Green.	196
" 11	" Etna	Hamburg...	Can. Pac. R. Co.	2
" 11	" "	" (via L. P.)	Wilson & Green.	244
" 12	" Eri King	London...	Millar & Co.	235
" 16	" Canadian	" "	Wilson & Green.	444
" 16	" Lauderdale	W. Hartlepool	Lomer, Rohr & Co	200
" 18	" Circe	Glasgow...	Wilson & Green.	212
" 19	" Port William	Bowling...	Lomer, Rohr & Co	225
" 23	" Bk. Paregio	Glasgow...	Wilson & Green.	150
" 23	" S.S. British Prince	" "	Lomer, Rohr & Co	305
" 23	" Canopus	Liverpool...	" "	190
" 23	" "	" "	Millar & Co.	185
" 26	" Michigan	London...	Lomer, Rohr & Co	220
" 29	" Lake Huron	Liverpool...	" "	375
" 31	" Montreal	" "	" "	325
Aug. 2	" Grecian	London...	Millar & Co.	300
" 2	" "	" "	Wilson & Green.	387
" 2	" "	" "	Lomer, Rohr & Co	180
" 3	" Bonnington	Liverpool...	" "	300
" 6	" Kehrweider	Hamburg...	Wilson & Green.	256
" 6	" Merch't Prince	London...	Lomer, Rohr & Co	300
" 6	" Vancouver	Liverpool...	Millar & Co.	130
" 14	" Steinhof	Hamburg...	Lomer, Rohr & Co	240
" 16	" Gordon Castle	London...	" "	385
" 17	" Gleniffer	Liverpool...	Millar & Co.	250
" 17	" Ocean King	London...	Lomer, Rohr & Co	50
" 17	" Assyrian	Liverpool...	Wilson & Green.	258
" 20	" Circe	Glasgow...	" "	185
" 21	" Earl of Zetland	Liverpool...	Lomer, Rohr & Co	350
" 22	" Bk. Skjald	W. Hartlepool	" "	100
" 23	" S.S. Hilaria	Liverpool...	" "	493
" 26	" Acuba	London...	" "	100
" 28	" Toronto	Liverpool...	Millar & Co.	425
" 30	" Geronia	London...	Lomer, Rohr & Co	392
" 30	" Osiris	Grimsb'y...	" "	200
" 31	" Bk. Eidsiva	Cardiff...	" "	100
" 31	" S.S. Concordia	Glasgow...	Wilson & Green.	400
Sept. 14	" Canopus	Liverpool...	" "	384
" 14	" Alcides	Glasgow...	Lomer, Rohr & Co	250
" 17	" Angers	London...	" "	150
" 17	" Harbinger	Glasgow...	" "	200
" 19	" Vancouver	Liverpool...	Millar & Co.	100
" 18	" Sarnia	" "	" "	200
" 19	" Eri King	London...	" "	200
" 19	" "	" "	Lomer, Rohr & Co	150
" 21	" Sin'at'n Tower	" "	Wilson & Green.	200
" 24	" Haverton	" "	Lomer, Rohr & Co	168
" 27	" Circe	Glasgow...	" "	200
Oct. 2	" Freia	Hamburg...	" "	120
" 2	" Toronto	Liverpool...	" "	220
" 4	" Abergeldie	London...	" "	240
" 14	" Lake Ontario	Liverpool...	Millar & Co.	180
" 15	" Gremion	Hamburg...	" "	240
" 17	" Michigan	London...	Lomer, Rohr & Co	240
" 18	" Bk. Lake Ontario	Liverpool...	Wilson & Green.	520
" 19	" S.S. Alcides	Glasgow...	Lomer, Rohr & Co	200
" 23	" Steinhof	Hamburg...	Wilson & Green.	200
" 23	" Sarnia	Liverpool...	Millar & Co.	200
" 25	" Colina	Glasgow...	Wilson & Green.	170
" 25	" Horton	London...	Lomer, Rohr & Co	147
" 31	" Circe	Glasgow...	Wilson & Green.	307
Nov. 6	" Toronto	Liverpool...	Lomer, Rohr & Co	208
" 6	" Dominion	Bristol...	Wilson & Green.	100
" 8	" Concordia	Glasgow...	Lomer, Rohr & Co	150
" 9	" European	London...	" "	210
" 16	" Gordon Castle	Glasgow...	" "	370
" 16	" Lake Ontario	Liverpool...	" "	250
" 16	" Ontario	Bristol...	Wilson & Green.	100
Total				23,540

* 134 bags.

† 2 bbls.

‡ Via Akerdeen.

RECAPITULATION.

Shipper.	Tons.	Bags.	Bbls.
Lomer, Rohr & Co.	13,633		
Wilson & Green.	6,017	134	
Millar & Co.	3,540		
Can. Pacific R'y Co.			2
Anglo-Can. Phosphate Co.	350		
Total shipments to Europe	23,540	134	2

DISTRIBUTION OF QUANTITY EXPORTED.

	Tons.	Bags.	Bbls.
Liverpool...	10,453		
London...	6,420		
Glasgow...	3,891	134	
Hamburg...	1,491		2
Bristol...	200		
W. Hartlepool...	300		
Hull...	260		
Bowling...	225		
Grimsb'y...	200		
Cardiff...	100		
Total exported to Europe.	23,540	134	2

Exported to United States from Ottawa Valley.

Month.	Value.
January	\$2,441 02
February	1,519 50
March	700 00
April	1,949 85
May	1,660 00
June	1,320 00
July	2,760 00
August	3,000 00
September	4,000 00
October	4,000 00
To November 22nd	2,300 00
Total value	\$25,650 37

Or, at \$10 per ton, 2,565 tons of ground phosphate, shipped entirely by Millar & Co. and Lomer, Rohr & Co.

DISTRIBUTION OF SHIPMENTS TO UNITED STATES.

Point.	Value.	Tons.
Chicago	\$11,441 02	say, 1,142
Buffalo	13,599 50	1,362
Detroit	599 85	60
Philadelphia	10 00	1
Total value	\$25,650 37	2,565

From Kingston mines, as per Customs returns.. 361

Total tons to United States..... 4,926

Summary of Output from Canadian Mines for 1889.

	Tons.	Bags.	Bbls.
Shipped to Europe	23,540	134	2
United States	2,565		
Estimated quantity held over at mines	5,000		
Total output	32,466	134	2

Du Lievre District.

From returns received, the North Star Mines have been unquestionably the largest producers this year, quite 10,000 tons having gone forward, while a large quantity has been held over until next season. Capt. Williams has from 50 to 60 hands employed, and a steady output is maintained. All the pits looked well. Copeland and Bacon, New York, have lately furnished a new hoisting engine, and we believe other plant will shortly be added.

The shipments from the High Rock Mines will, we believe, be somewhat less than former years. We should judge that a little over 6,000 tons have been shipped to date. A good deal of dead work had to be done early in the season, which will account for the falling off from former years. About 150 men and boys are now employed, and all the pits, particularly the Cap Rock, are showing up well. Like the other mines, the High Rock has been compelled by the scarcity of freight to hold over a large quantity until next year.

Among the new companies lately registered in London is the Dominion Phosphate Company (Limited), registered by Johnson, Budd & Johnson, 24 Austin Friars, E.C., with a capital of £40,000 in £5 shares. The property acquired (Lot 7 Second Range, Portland East) is situated on the left bank of the river, within easy distance of the Little Rapids Landing, and was formerly owned by Angus McMillan. The price paid, we understand, was \$15,000 cash. Mr. Pielsticker, the superintendent, with a good force, is now actively opening up the property, and producing a good output of excellent quality. A little over 200 tons have been raised since operations were begun.

Messrs. Hutchinson and Würzburger, who have been spending the last few weeks in a close and minute inspection of our sources of phosphate supplies in the interests of the Anglo-Continental Guano Co. (formerly Ohlendorffs), have returned to England, thoroughly well pleased with their trip and with their investigations. Before leaving, we understand, they completed, on behalf of their company, the purchase of the property of Mr. A. F. McIntyre, consisting of 200 acres, and located immediately adjacent to the Emerald mines, in the township of Buckingham. The price is not stated, but we have heard \$60,000 mentioned as the amount probably paid. The necessary plant, and an efficient force will at once be set to work the property on an extensive scale. A small gang is now engaged in preliminary working. The appointment of a manager is not yet announced.

There has recently been uncovered on the Aetna Lot (part and parcel of the property acquired by the Anglo-Continental Guano Co.) a monster crystal of green apatite, weighing several tons, and probably the largest in the world. Its dimensions are seven feet long by four feet wide. It is perfectly formed. An endeavour will be made to excavate this enormous crystal in its entirety.

We have nothing to report from the Emerald mines. The shipments are thought to have been below the average of previous years.

Mr. W. A. Allan continues to carry out his plan of the systematic development of his Little Rapids mine. At present the men are employed on several excellent shows, in which, at our last visit, large masses of rich phosphate were exposed.

Recent advices from the district state that all the pits of the Canadian Phosphate Company are doing fairly well. It is estimated that quite 3000 tons of cobbled phosphate have been held over at the mines. As will be seen from a reference to the table of shipments, the quantity exported by the company to Europe was 3540 tons, while a large quantity of lower grade was sent in a ground state to the United States.

Templeton District.

The shipments from the Blackburn mine aggregate about 1,200 tons. This is much less than in former years, and is altogether due to the amount of improvement work done on the property during the season.

Perth District.

At the Bob's Lake Phosphate Mines, the Anglo-Canadian Phosphate Co. continues to secure a large output for the number of men employed. From one pit 53 tons were mined, cobbled and piled in three weeks by 5 men and 2 boys, the hoisting being done by horses. A seam 200 feet in length and four feet wide has been opened in the past month. The surface ore in this vein is mixed with iron, but is likely to improve at a depth.

Mr. Würzburger, a Belgian engineer, has visited the Otty Lake and Bob's Lake Phosphate mines lately in company with Mr. Richardson of Kingston. He has been taking notes of all the principal properties in the country.

Mr. Wm. Davies of Perth is having contract work done on a lot near Otty Lake, belonging to Mr. Morris. Some good seams have been

opened, one of which is said to be seven feet in width. One of the oldest miners paid \$50 for a half interest in the working of it on contract at \$6 per ton.

A surveying party is now locating the route for the extension of the Brockville & Westport Railway to Sharbot Lake. They have located the line across the narrows of Bob's Lake at Kilpatrick's, and through the lots on which the Bob's Lake Phosphate mines are situated. This will give the best possible facilities to the phosphate industry of that region. American capital has been secured and the line will be built next summer.

Kingston District.

We are advised that the old Board of Directors of the Foxton Mining Company has been reinstated, and that the first allotment of shares has been ratified. The mine continues to turn out about 300 tons per month of high grade ore. Since 1st of May to close of navigation some 850 tons have been shipped from the mines.

The value of the phosphates exported from this district to Great Britain and the United States since 1st January to date, is officially stated at \$11,944.

Capt. Boyd Smith has resumed operations at the Blessington mines.



Nova Scotia.

Miscellaneous.

At the Albion Colliery, the further sinking of the "English" slope has been suspended. How long this suspension may last is uncertain. The machinery, so far employed in sinking, is not heavy enough for more extended operations, and the company may not be in a position at present to procure the machinery to the full equipment of another colliery. The work done is satisfactory, and has demonstrated that a large area of good coal in the Cage pit seam is readily procurable. The further the sinking went the better the coal became. The bottom bench contains three feet to three feet six, and the fall two feet of excellent coal, with a thickness of two feet between of harder coal. This stone bench, as it is called, disappears towards the deep, and at a further distance of 100 feet it is believed the seam is of a uniform, superior quality. Before the slope, which has been sunk some 1,700 feet, can be successfully operated, a new hoisting engine is necessary, and also a branch railway connecting with the main line.

The following are the successful candidates for certificates of competency at the recent meeting of the Nova Scotia Examining Board:

UNDERGROUND MANAGER'S CERTIFICATES.—A. McDonald, Cow Bay; John Carey, Sydney Mines; D. H. Ferguson, Victoria; Isaac Greenwell, Victoria; S. F. Lee, Victoria; Bart Connors, Victoria; G. W. Greenwell, Victoria; E. McPhee, Victoria; A. Ferguson, Victoria; H. McKinnon, Stellarton; A. D. McKenzie, Stellarton; H. McCarter, Stellarton; A. McDonald, Stellarton; W. Lorimer, Maccan; T.

Blackwood, Maccan; C. Hargreaves, Spring Hill. **OVERMEN'S CERTIFICATES.**—Murd. Morrison, Cow Bay; R. B. Crosby, Cow Bay; Chas. Young, Sydney Mines; Ed. Lockman, Sydney Mines; M. Sullivan, Sydney Mines; John Dorsay, Sydney Mines; David Brown, Sydney Mines; Thos. Johnstone, Bridgeport; John Caddigan, Bridgeport; Alex. Cameron, Victoria; D. Ferguson, Victoria; A. McAskill, Victoria; M. H. Nicholson, Stellarton; A. Babine, Maccan; Charles Rennie, Springhill; Arch'd. Ferguson, Spring Hill; W. Matthews, Spring Hill; George Yarrow, Spring Hill; Alex. B. Wilson, Spring Hill.

Rockingham.

There has been a newspaper excitement for some time past over the discovery of lodes near the "Prince's Lodge," supposed to be gold bearing, but a close examination of the lodes as yet stripped fails to discover any gold in them. Rumor has it that a mill is to be built there at once; it is to be hoped that such is not the case, for very much development work is needed upon the lodes already found before there can be the least foundation for such an expenditure of money.

Ardoise Hill.

The property of the St. John, N. B., Company, formerly operating here, was sold by the Sheriff on Thursday, October 10th. It is understood that the property was bought in for the shareholders, and that the old company will be re-organized.

Central Rawdon.

Manager Willis has ordered from I. Matheson & Co., New Glasgow, two new boilers for the Northup Mine, each is 4½ by 14 feet, and is nominally 60 horsepower. New pumping and winding gear will be added shortly.

North Brookfield.

The new mill of the Philadelphia Gold Mining Co. is nearly completed, and will be turned over to the company by the contractor before the end of October. The mill has 20 stamps.

Fifteen Mile Stream.

The Egerton Company has encountered a richer streak of ore towards the eastern end of their workings. Returns for September show 131 ozs. from 183 tons crushed.

Killag District.

Late advices from this district show that the lode referred to in September issue has been cut. Owing to the protracted drought of this summer the large swamp was dried to a greater extent than was ever known before, and Mr. Stuart put some men at work sixty feet north of his main shaft in line with his rock crosscut. To his surprise but six feet of surface were encountered, and the shaft came down nearly upon the lode. The lode thus exposed is about 10 inches wide, and judged worth \$30 per ton. The steam hoisting and pumping gear is being moved to the shaft on the new lode, and work will continue all winter.

New Brunswick.

The Markhamville mines are now owned and operated by The Pope Manganese Company, of 62 Franklin street, Boston. W. C. Pope, Esq., is general manager, and Major Markham is the manager at the mines, as he has been for upwards of 23 years. The new company have added to their plant a Diamond drill from the Bullock Manufacturing Co., of Chicago, for prospecting purposes, and a cyclone mill from the Canada Pulverizing Company, of Montreal, for grinding Manganese; both machines have been in operation some weeks. About fifty

lands are constantly employed in and about the mines and mills. High class manganese milled and prepared for consumers is being constantly shipped to headquarters in Boston for distribution to customers all over the United States and Canada, and several cargoes of blast-furnace ore have been shipped to steel furnaces in Pennsylvania during the summer.

While very little work has been done at the Stockton mine, during the summer, a number of speculators and so-called experts have visited the property, and it is reported that offers have been made for its purchase, but the owners still have a fancy price on it.

The Quac mine is being operated again by a Boston company, and one shipment of about 40 tons of blast-furnace ore has been made to the United States. Mr. Morrison is the foreman at the mines. He reports about 150 tons now ready for shipment to Carnegie Bros., Bessemer, Pa.

Application for incorporation is made by the Welsford Red Granite Co., for the purpose of quarrying red granite at Welsford, Queen's Co. The capital is \$50,000 in 1,000 shares, and \$10,000 has already been subscribed. The following are the first directors of the new concern: B. Sancton, banker, New York; A. J. Trueman, barrister, St. John, N. B.; J. A. Chesley, manufacturer, St. John; R. Wisely, St. John; John O'Connor, St. John, N. B.

Mining matters here are comparatively quiet at present, but there is a possibility of considerable capital being expended in the near future. The manganese deposits of New Brunswick attract considerable attention. The chief deposits are in King's County, near Sussex, where are located the well known Markhamville mines, which have been worked continuously for thirty years or more, and show no signs of exhaustion. This property is managed by Major A. Markham, of Markhamville, and affords employment to a large number of employees. The ore is exported to Nova Scotia and Great Britain.

Two other manganese mines are in this locality—one, known as the Jordon Mountain mine, on which exists a large body of ore suitable for steel purposes. It is rumored at the present time that American capitalists are negotiating for the purchase of this property. This mine is about six miles from Sussex station, on the Intercolonial Railway.

In the Dutch Valley district, in same direction as the Markhamville mines, is a property known as the "Glebe," owned by Bar Harbour and local parties. It has had considerable development and bids fair to be a productive property. The ore is of a high grade and very pure indeed.

Manganese is also reported in the vicinity of Golden Mountain, in Albert County, in paying quantities. Near Hopewell or Hillsboro, in Albert County, are deposits of manganese, and it is said a property of wad or bog manganese has recently been sold to American capitalists. Manganese is also reported to occur in the northern part of New Brunswick, but enough work has not been done to establish the paying capabilities of the same.

Near Bathurst, in Gloucester Co., a valuable vein of magnetic iron ore has been recently disposed of to New York parties at a fair price,

and work of development is now in course of progress. The ore belt is fully 30 to 40 ft. in width, and assays have shown fully 66 per cent. metallic iron with great freedom from silver, phosphorous, etc. Running parallel with the ore vein is a load of yellow sulphate of copper fully 6 ft. in width, giving about 13 per cent. copper. This bids fair to be a very valuable property.

Lead and silver ore in good paying quantities exist in Gloucester Co., on the Mackadoo and Elm Tree rivers, and would repay the expenditure of capital. Specimens of galena from the Elm Tree mine have assayed as high as \$300 per ton, and in some instances associated with it as high as 22 dwts. of gold.

Recently a galena vein of good paying character has been discovered at Jacksonville, a few miles from Woodstock, and work of exploration is being vigorously carried on. A shaft has been sunk 50 ft. up to present date, and prospects look exceedingly bright.

Lead and silver or galena ores occur at several other points in New Brunswick. On the Hammond River, in Kings County; at Musquass, in St. Johns County, and in several other localities, very little has been done to develop them.

The iron deposits of Woodstock which were worked some years ago are extensive, and in these days of scientific treatment, iron ores should be profitably worked by capitalists.

The gypsum or plaster mines of Hillsboro are being vigorously worked, and with the completion of the Tobique railway now under contract, the immense plaster deposits of this locality will no doubt be extensively worked. Plaster deposits also occur in paying quantities in lower portion of Kings County, in the vicinity of Upham.

In St. George and along this peninsula large deposits of yellow sulphuret of copper exist, and beyond doubt could be profitably worked. Along the Bay of Fundy shore, near Point Wolfe, other ores exist in paying quantities.

In King's County, brine springs are quite numerous, and at or near Penobsquis small works are in operation. The salt manufactured here is beyond doubt superior to any in Canada, and with the application of capital to run them on a large scale, could beyond doubt be made to pay handsomely.

Finally, in this somewhat rambling description, it may be safe to say that those who have given the subject considerable thought have a firm and abiding faith that gold will be found yet in paying quantities. Geological reports on the Province show gold at several points, and it is currently said it exists beyond doubt on the Tobique. Gold has been found in the drift or sand in some of the streams of Albert County, and evidences of it have also been found in the St. George District. No regular or systematic search has been made for it, but the time is not far distant when it will be, and with a modification of our mining laws, which are somewhat crude, and which it is proposed to amend this coming session of the Local Legislature, we may hope for a vigorous research for this much coveted article.

It is reported that the somewhat singular deposit of bog manure in Albert County has been sold to New York people.

Mr. Fenwick Fraser, of Rothesay, and others, are doing some prospecting in Albert County, on a lead of galena and silver, a shaft has been sunk upwards of 50 ft. with very encouraging results.

Mr. James Martin, of St. Martins, and Mr. N. Shaw, of St. John, have made some trial pits on a lead of silver and galena at Musquash, in St. John County, with like cheerful prospects.

Quebec.

Notwithstanding the unfavorable weather, operations are going on briskly at all the mines, and large shipments of asbestos continue to be made.

Mr. William King has had the debris from the recent land slide cleared out of his main pit and mining is now being conducted on some excellent veins. The explorations on Lot 28, 5th Range, Thetford, and on the property in the Township of Ireland have proved eminently successful. These reserves give promise of excellent returns.

Shipping from the Bell's Company pits continues to be brisk. We observe that the shares of company put on the market last year at £5 are now quoted at £20.

Great activity is also noticeable at the pits of the American Asbestos Co., the Johnston-Irvine Co., and other concerns.

The United Asbestos Company (Ltd.), London, Eng., has recently acquired the interests of the Frechette Mining Company, at Black Lake, Megantic County. The property consists of 75 acres fairly developed, and the price paid was \$70,000. This concern has hitherto been one of the largest users of Italian asbestos. Mr. John J. Penhale, formerly of the Scottish Canadian Company, has been engaged as mining superintendent. Orders have been given for a complete plant, and as soon as this is in place, operations will be carried on in a large scale.

The production of Canadian asbestos for the fiscal year ended 30th June last, is estimated to have been close upon 5,000 tons.

A fair output of copper is maintained at the Harvey-Hill mines. The smelter gives satisfaction.

The British North American Mining Co. has issued a call of thirty cents per share to meet municipal taxes.

Dr. Jas. Reed, will, we understand, commence work shortly on his property, Lots 27, 28 and 29, Range A, Coleraine. A plant similar to that in use at the American Asbestos Co., will be used.

Messrs. Thompson & Sheridan, of Toronto, have purchased 300 acres of land lying in St. Sophie parish, Que., in which it is said, are large and valuable deposits of marble, equal to the finest found in Italy.

The Plumbago mines and mills near Buckingham are now working full time. Shipments to the States give great satisfaction.

Messrs G. H. Nicholls & Co. of New York, have commenced operations at their New Smelting Works at Capelton. The demand for this Company's superphosphate is, we are glad to say, steadily increasing.

The Bristol Iron Company having made a large sale of ore to the Crane Iron Company, of Catasqua, Pennsylvania, have commenced shipping. 1,500 tons have already gone forward, and the output is being daily increased as experienced miners arrive from other mining districts. The Bristol ore being a strictly Bessemer ore, high in iron and low in phosphorus, is being sought after by the large steel companies, especially by those making a specialty of low phosphorus steel, such as the Crane Company. The ore is loaded in cars at the mine, as the short line built by the owners of the mine to connect with the P. P. J. Ry. at Wyman's station is in operation. The C. P. R. takes it from Aylmer to Prescott, the Rome, Watertown & Ogdensburg takes it to Sterling Junction, where the Lehigh Valley Ry. connects and takes it to the furnace. We shall watch the development of the business of this mine with much interest.

Ontario.

We understand that a delegation from the Town Council of Lindsay has waited upon some members of the Ontario Government to urge upon their attention a scheme which aims at developing the iron mines near Kinmount and the extension of the Irondale and Bancroft railway. A public meeting was held in Lindsay last week to discuss the same project, the mayor in the chair, members of the Board of Trade and a number of citizens being present. The project was explained by Mr. Pussey, who said they had the written guarantee of Mr. Dodge, of New York, to provide funds for the extension of the railway. Mr. Witherow, of Pittsburgh, an extensive builder of smelting furnaces, said he had carefully examined the mines and pronounced the ores richer than those of Northern Michigan. He proposed to erect a furnace that would cost \$125,000, that would require 200 cords of wood per day for charcoal, and that would turn out 100 tons a day of charcoal pig iron. The location had no superior in the United States for charcoal iron. He had confidence in the project, and might take \$20,000 in stock in January. Mr. Pussey said they desired a bonus of \$10,000 each from the counties of Haliburton, Peterborough, and Victoria, as these sections would experience direct practical benefit from the opening up, settlement, and development of the mining district. Also they desired to obtain from the Ontario Government a bonus of \$2,000 a mile for the railway, and the right to purchase 30,000 acres of wild land for the iron mines. Mr. Witherow also gave an interesting practical address, in which he referred to the feasibility of establishing iron furnaces in the locality. A resolution was finally moved by Mr. John Dobson, seconded by Mr. Richd. Sylvester, and carried, recommending that the Ontario Government be urged to assist the enterprise.

Surely it is time that the Report of the Mining Commission was in the hands of the public. The Report was promised for the last session of the local legislature, but was not

forthcoming when the House prorogued. We were assured it would be ready for distribution at the recent Meeting of the American Institute, and again we were disappointed. When the Report *does* come out, its value will be very much depreciated on account of this inexcusable dilatoriness on the part of the Commissioners.

The small stamp mill at Flinton was destroyed by fire on Thansgiving day. Loss estimated at \$2,000. A new mill is to be built immediately.

Port Arthur District.

A steady output from the Beaver, Badger, Elgin, Shuniah Weachw, Crown Point and West End mines continues satisfactory.

Iron lands are still eagerly sought after and no little interest is taken in the nickel and gold deposits—splendid specimens of the former being obtained on the north shore of Lake Superior, along the C.P.R. line, not far east of Port Arthur.

Promoters of reduction works are looking after the splendid water power in this neighborhood, as much of this class of work can be cheapest done by electrical appliances. The water powers are both magnificent and numerous.

The Beaver has now attained a depth of 530 feet. Nothing but development work has been carried on at this mine for the past 18 months. They are now about to commence stoping and shipping. They have sufficient mill rock on the dump and in sight in the mine to run their mill for two years, but it is not proposed to start it up until about the 1st of May next. Their first shipment of high grade ore, consisting of 40 barrels, is now ready and will be made within a few days. They have just placed in position at the bottom of the mine an improved diamond drill capable of boring 1,200 feet in depth.

Mr. Oliver Dounais still continues work on his Lake of the Woods properties. Six assays made from the whole vein average nearly \$22 per ton and as these assays are not made from picked specimens, but from the whole vein, and as the ore can be mined and milled for from \$8 to \$10 per ton, there is a handsome profit in prospect.

North-West Territories.

A special general meeting of shareholders of Alberta Railway & Coal Co., will be held at London, England, on 2nd December next. The objects of the meeting are: To ratify an agreement with the Great Falls and Canada Railway Company; to ratify an agreement with the North Western Coal and Navigation Company, limited; To authorize the issue of bonds and shares required under said agreements.

British Columbia.

A recent shipment from the Rock Creek mines of 60 tons to San Francisco averages \$1,100 ounces of silver and \$700 gold per ton. As it cost the company \$100 per ton to pack this shipment to the railway, no further evidence is needed to show that the construction of good roads is an urgent necessity.

The shipments of Texada iron ore were: September, 675; October, 750; Total, 1,425 tons.

The following is a summary of the shipments of coal from the port of Nanaimo for the months of September and October:

Name of Company.	Sept.	October.	Total.
	Tons.	Tons.	Tons.
Vancouver Coal Co.	7,744	12,702	20,446
Dunsmuir & Sons.	19,941	17,933	37,874
East Wellington Coal Co..	4,774	1,858	6,632
Union Colliery Co.	2,450	7,044	9,494
Total.	34,909	39,537	74,446

We understand that negotiations have been completed by Mr. S. M. Robins and Mr. L. Rosenfeld on behalf of the New Vancouver Coal Company, for the bonding and purchase of the extensive coal lands in Cedar District, about five miles distant from this city and nearly contiguous to the present South Field property of the company. The amount of land purchased will aggregate 3,260 acres, and is the same land which the famous Dr. Griffin secured a bonding right thereon, which he so ingloriously allowed to lapse by effluxion of time. The new Vancouver Coal Company is to be congratulated on the successful acquisition of this valuable coal property. Among those who have bonded their land are Mayor Bate, E. Quennell, Charles York, T. D. Jones and T. Wall.

The completion of the sampling works in connection with the Revelstoke Smelter and the announcement that the company owning the same is now prepared to purchase all ores that may be offered for sale, are matters of satisfaction to every one interested in the welfare of the province. Although the works are not yet in a condition for actual smelting, the company are prepared to sample and buy ores, so that the miners are now assured of a market. Great credit is due to the company and its management for the progress made, and it is to be hoped that the financial results will be all that the energetic promoters expect.

Quantity of Steel in the Forth Bridge

—The Firth of Forth bridge at Queensberry, Scotland, will use 50,000 tons of the finest steel, and one of its cantilevers, if placed on end, would be nearly as high as the Eiffel tower. The latter contains 7,500 tons of iron.

A Large Cable Hoisting Machine.

The Trenton Iron Co., of Trenton, N. J., has completed a tramway in the Blackington Farm quarry, of Rockland, Conn., which has one of the longest stretches of cable and is one of the biggest plants of its kind in this country. The cable is 1½ inches thick, of cast steel with a steel centre, and is 1,255 feet long. The weight of the wire on its reel was 10,000 pounds. The anchorage weight, at the lower end, is 75 tons, while the weight of the wire, with its pulleys, cars, etc., is 36 tons. The breaking strain of the wire is 110 tons. The cable is passed over towers 42 feet high, and the wire in the sag is 125 feet above the quarry floor. The hoisting apparatus consists of a travelling car, which goes back and forth on the wire, never leaving it, and 19 trolley blocks which support the wire that controls the fall block, which lowers the drag or bucket into the quarry. The apparatus allows the drag or bucket to be lowered and hoisted from any point on the quarry floor the entire length of the wire.

The Sudbury Mines and Works.

(Continued from last issue.)

Dr. PETERS—Pyrrhotite does not contain cobalt. I have made some experiments with phosphorous and nickel but they have been very unsatisfactory. Grenier in Germany has made some announcements of finding very valuable alloys with nickel and phosphorous, and is going to make them public. What Dr. Raymond said about sweeping away the cobwebs around the metallurgy of a few years ago, is one of the truest remarks I have heard, and he has put it in the happy way that is characteristic of most of his remarks. I could name half a dozen different things, if I had time, but one thing is the steep, the mixture that the furnace bottom is made of. I have sat for hours listening to the proper proportion of charcoal. I think there were three lectures at Freiberg on the steep; but I got rid of steep very quickly when I got into smelting. At Elt they used it, but we smelt right against the water jackets of the furnace. Another matter was the length and shape of the nose of the furnace. I mean the prolongation of the inside or tuyere holes. In our ancient metallurgy it had to be just so, but now all we do is that once an hour a man goes around and knocks the little acretia off. As regards salamanders, which were the bane of metallurgy, they made me once swear I would never start a blast furnace. I have not seen a pound of wrought iron in a furnace for ten years—never since we have used these wells in front. I will tell you a short story which I gave once in Boston. The audience sat so gloomy that I wrought in this story, not to enliven them altogether, but as a matter of instruction to some member to whom it might prove useful as a warning. It was when I first began smelting in Colorado, and it was while running that furnace I first met Dr. Raymond. I was just starting out and was very young—just twenty years old—and it was the first opportunity I had of showing what I was worth. In those days failure was so common in all those smelting enterprises that nobody expected anything else in my case—except perhaps the people immediately concerned with the enterprise. Every smelting operation had failed, except Prof. Hill's, and that was the one star that relieved the darkness which enshrouded Colorado for a good many years. Just as soon as our company started putting up furnaces everyone felt it would fail. That was a foregone conclusion. We started putting up this furnace in South Park, and as I felt my whole future depended on how it should run, I took more pains with it than I have ever taken since. I fairly made myself sick over the work. I got the furnace built and spent hundreds of dollars in sampling ores. I had a chemist there. I took the greatest pains to get every kind of flux down to sulphate of soda—which was not needed however. I made all arrangements to start up, for the ladies were beginning to come over there and nearly all our directors came out. It was the Moose Mountain Smelting Company, and our directors nearly all came out with their wives, and sisters, and cousins, and aunts to see the furnace start (laughter). It would be the making of the district if it should run, because it would afford a market for custom ore. No person, however, had any confidence in my success, except those perhaps around me. Some of them felt uncertain. To make a long story short, we started up with charcoal—miserable soft stuff—and I took the greatest pains to have the most fusible ores with plenty of lead in them, and everything as nice as could be. I felt nervous about it, as it was my first attempt. We started by putting in a small charge of slag and gradually increasing it, replacing one shovelful of slag by one of ore, and so on until it was time to leave the feeding floor and look in at the tuyeres, in order to see how my noses were getting on. Instead of seeing what I expected, I saw long ropes hanging down like icicles. I thought the fire brick lining was beginning to melt. In about ten or fifteen minutes these tuyeres were stuck up completely and in about an hour the furnace was stuck up too. I tore it out and my directors looked a little long in the face when I started up again. I could not vary my charge much. I had figured it out exactly, but I made it still more basic than before, but by midnight it was frozen solid and worse than before. If there was ever a desperate man it was me. The directors, however, treated me kindly. They said:—"Here you are played out; go up to the house and lie down, you will feel better to-morrow." I went up with the feeling that my whole professional career was blasted. I had lost my faith in natural laws. I knew some such combination of iron slag and limestone must smelt; but it would not (laughter). You can imagine how I felt at the time. I looked down the muzzle of my Colchester for ten or fifteen minutes at a time, but did not have nerve enough to use it. Finally I fell asleep. In the morning the secretary of the company came to my door and entered with a smiling face, holding in his hand a cocktail, which Mrs. Dudley had the faculty for making. I said:—"You look pretty happy for a director whose furnace has come to grief" and

took the cocktail—as a medicine (laughter). He said:—"Oh, come down and see it. It has run out half a car-load of bullion since midnight. It is running all right." I put on my clothes and went down and found what he said to be true. They had taken out \$6,000 or \$7,000 worth during the night. The truth of the matter was this:—I had with me an old Mexican metallurgist, an old smelter with a practical knowledge of the business. He knew my charge must have been correct, and could rely on that. He went up to investigate, and found the charcoal was full of gravel and stones. The burners had been covering their charcoal with gravel, and the result was that the more charcoal I was using the more infusible a charge I was getting. That was no secret. (Applause).

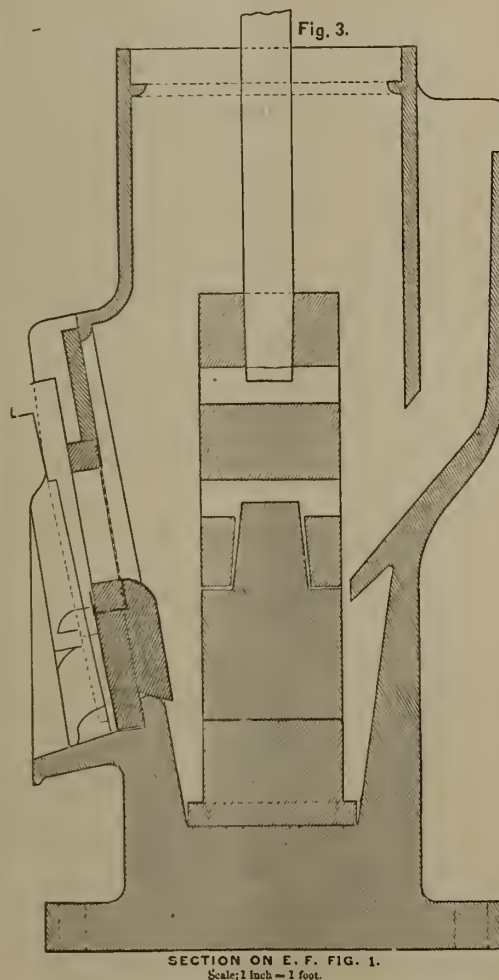
Gold Milling in the Black Hills.

(H. O. Hoffman, Rapid City, Dakota.)

(Continued from September issue.)

2. In the Golden Star mill, the power is transferred from a small main shaft to two line-shafts on the cam floor, the main shaft being nearly on the same level. This arrangement is favoured by builders on the Pacific coast. It is shown in Providence mill, Nevada City, Cal., for description and drawing of which, see the paper of Mr. F. D. Browning on "Gold Chlorination in California, in the *School of Mines Quarterly* for 1884, also printed in the *Scientific American Supplement*, No. 445, July 12, 1884.

3. In the Highland mill, (see Plate), the small main shaft is placed between cam-floor and battery-floor, and is connected with two line-shafts, placed on the battery sills, behind the mortars.



THE HOMESTAKE MORTAR AND STAMP

Both of these mills have two line-shafts, which is probably necessary considering the power that is required for a 120-stamp mill. The disadvantage is that the pull of the belt, on one side only of the shaft, has a tendency to draw it off the line, and also causes great wear and tear. As to placing the line-shafts in front of the batteries on the cam-floor, or behind

them on the battery-floor, there is a diversity of opinion. The former arrangement, as at the Golden Star mill, gives the best light in the mill and makes the shafts easily accessible. The power from the engine-shaft is transmitted to the line-shafts, and from these to the cam-shafts, by long belts, which are nearly horizontal. They require no tighteners, and last longer than those of either the Homestake or Highland mills. On the other hand, the boxes of the line shafts rest on transverse sills on the cam-floor, which, although braced and strengthened in various ways, cannot furnish the same sure foundation as that at the Homestake and Highland mills. Experience has shown, however, that this disadvantage is more than counterbalanced by the smaller consumption of belts and the easy accessibility of the line shafts. The Highland mill has the line-shafts on the sure foundation of the battery-sills; but the darkness and the exposure of the line-shafts, thus placed just behind the mortars, to the trickling of water and fine ore, are serious disadvantages. Again, the belts from the main shaft down to the line-shafts, and from these up to the cam-shafts, are short and steeply inclined, requiring powerful tighteners, which cause an increased consumption of belts. The mill, however, like the Homestake, is so arranged as to leave the battery, with the apron and sluice plates, free from any superstructure.

The relation of the horse-power of the engine to each stamp averages for the seven mills about 1.7:1. This low figure is due to the large number of stamps in each mill (80 to 120), which is much higher than the common average in gold-mills.

Supply of Water and Fuel.—A regular supply of water is a prime necessity in milling. In this district it is chiefly furnished by two companies, at prices varying from 50 to 57 cents per stamp per day, the supply being brought in ditches. In winter water becomes scarce, and then the mills of the Homestake management are supplied in part by pumping from the Homestake and Deadwood-Terra mines. This water otherwise runs to waste. The big Highland mill would be obliged to stop four months each winter if the tailings of the Homestake; Golden Star and Highland Mills were not settled, and the clear water pumped back into the supply-tank. The method by which this is done is simple and effective. The tailings of the three mills are discharged together into the creek, called Gold Run. A little way further down, this broadens, and is closed by two dams, one below the other, forming two reservoirs. The upper overflows into the lower, which is four times its size, and this, in turn, has its overflow in the bed of the creek. The dams consist of cribbing, filled up solidly with waste rock. On their upper sides they are lined with water-tight planking. Down the middle of this, runs a wooden box, three sides of which are made of solid plank, the fourth being left open. When the reservoir is to be filled, this box is closed by pieces of heavy plank placed transversely. As far as the mere filling of the reservoir is concerned, the box might as well be closed by one solid piece, but the object of a number of pieces is to discharge the water gradually. This is done by removing the pieces, one after another, as the water is lowered, that the sands may be kept in suspension and carried through the culvert. Were the box opened at the bottom or to its full height at once, the sands would be carried into the culvert in such a quantity as to clog it. This culvert, in which the box ends, passes through the dam and under the lower reservoir and lower dam to the bed of the creek below. The

lower dam is arranged in the same way. When the reservoirs are not in use, the water of the creek passes off through the culvert. When they are to be filled, the boxes are closed. The water accumulates in the upper reservoir, until, after six hours, it overflows, leaving all the coarse sands in the upper reservoir, and carrying with it only the finer slimes, which settle in the lower one. From this the clarified water is pumped, at the rate of 60 cubic feet per minute, into the Highland tank, 200 feet above. The coarse sands are removed from the upper reservoir every twenty-four hours. In order to do this, the transverse planks closing the discharge are removed, one after another, and the water passes off, carrying the sands with it. As this process takes four hours, and the filling six, there are fourteen hours of overflow into the lower reservoir, where the slimes settle. These are removed once in two months, in the same way.

TABLE III.—Shafting, Breakers and Belts.

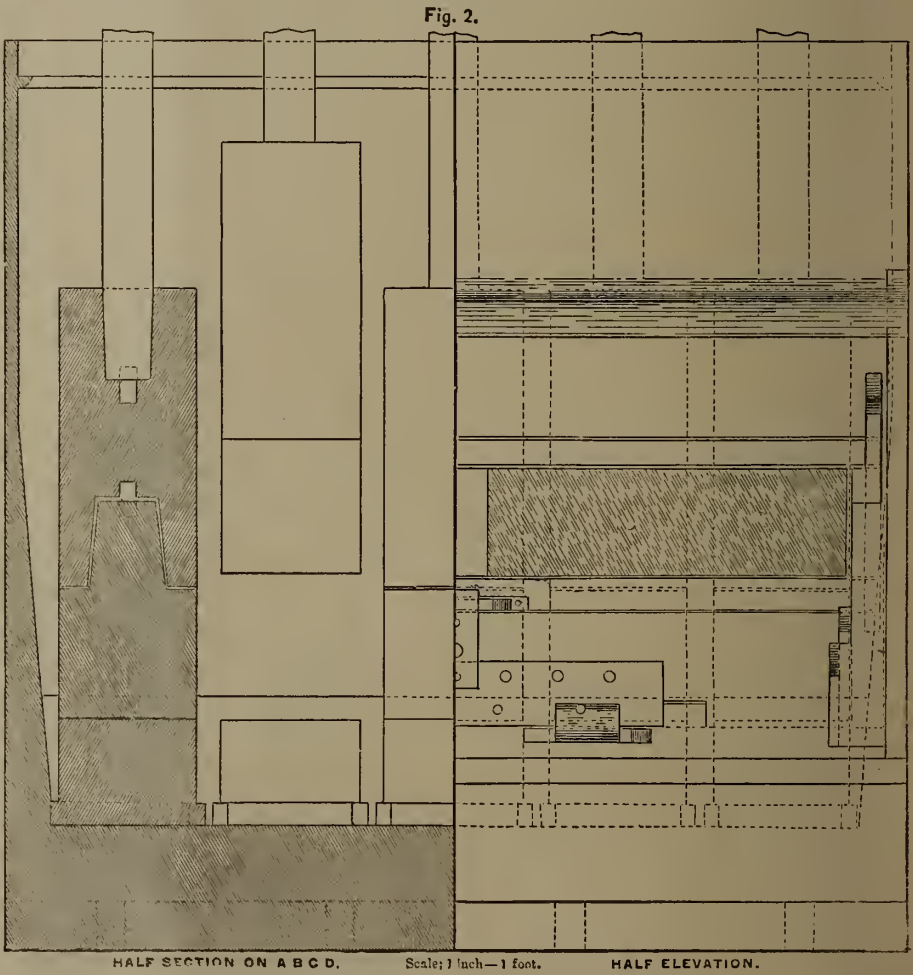
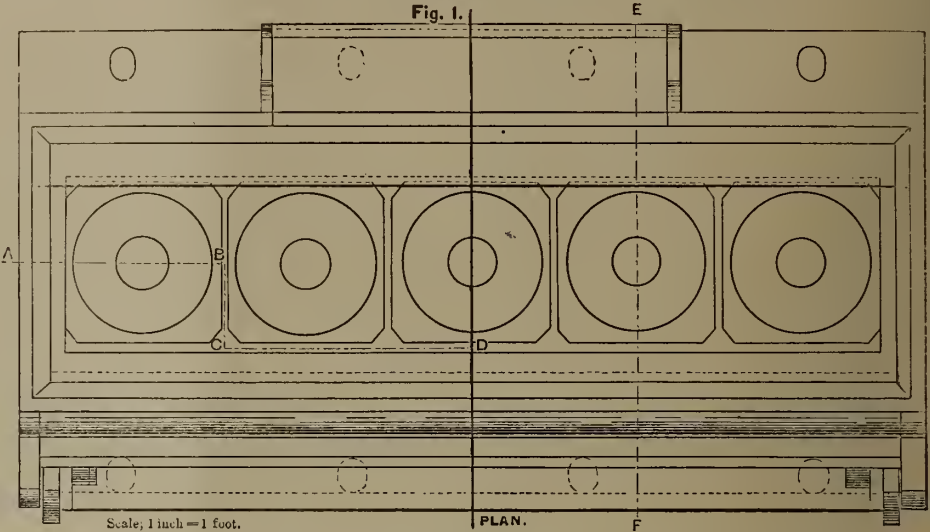
MILL.	LINE-SHAFTS.			ROCK-BREAKERS.		CHARACTER AND SIZE OF BELTS.												
	Number.	Diameter in inches.		Number.	Type.	Main-to Line Shafts.			Line-to Cam-Shafts.			Line-to Crusher Counter-Shafts.			Crusher Counter-to Crusher-Shafts.			
		Near Engine.	At Opp. End.			Type.	Ply.	Width.	Type.	Ply.	Width.	Type.	Ply.	Width.	Type.	Ply.	Width.	
Homestake	1	7	4½	5	E	.....	.....	.....	G	5	14	H	.....	.....	.....	G	4	9
Golden Star	2	9	4½	6	E	G	6	28	G	5	16	G	5	12	G	5	5	10
Highland	2	7	4	6	E	H	.....	41	G	5	12	G	5	12	G	.....	.....	.....
Deadwood	1	7	4	4	E	.....	.....	.....	G	5	12	G	5	12	G	.....	.....	.....
Golden Terra	1	7	4	4	E	.....	.....	.....	G	5	12	G	5	12	G	.....	.....	.....
Father de Smet	2	5½	3¾	5	E	.....	.....	.....	G	6	24	G	5	12	G	.....	.....	.....
Caledonia	2	5	4½	1	F	G	5	28	G	5	14	G	5	12	G	.....	.....	.....

E = No. 5 Blake Rock Crusher. F = No. 6 Gates Rock Crusher. G = Rubber. H = Leather.

The fuel for the mills under the Homestake management is supplied by the "Black Hills and Forte Pierre Railroad Company." This

road, with about thirty miles of 3-ft. gauge track, runs along the divide between Gold Run and City creek, terminating at a point about fourteen miles south of Lead City. The whole section was originally heavily wooded, but has been quite denuded by the constant demands made upon it. The railroad is very winding and is quite a feat of engineering. It runs down the slope into Whitewood Creek, and up the opposite height, until it finally reaches the point where timber is still to be obtained. This

down the slope of the mountain. The chutes, 25 in. broad by 12 in. deep, are made of 4-in. plank. The bottom and 9 inches of the sides are lined with ¼-in. iron. The fall of the chute is 6 in. to the foot until the curve begins, when it is 4½ in. This continues to the nozzle which is elliptical. When the chute is in use, a small current of water is passed through it to prevent the iron from becoming too hot, and also to act as a lubricator. The cord wood, unloaded into the top of the chute, passes down the incline



THE HOMESTAKE MORTAR AND STAMP.

road, as soon as spring opens, is employed in transporting the wood and timber which have been cut and stored along its line, and is in constant use until the heavy snows block it for the winter, generally from January till April. It has three branches, towards the three towns where the mills are situated, and communicates directly with these by means of long wooden chutes, down which the wood is discharged. These are from 700 to 1500 ft. long, running

with great velocity. At the nozzle it is deflected from its course, and, through the momentum obtained in its downward passage, shoots up into the air and drops some distance off on the wood pile. In order to discharge the wood on a somewhat large area, the nozzle is made movable. The Caledonia mill has its wood hauled by teams, but is making experiments with soft coal, as the price of a cord of wood in the district is six dollars.

Auxiliary Arrangements.—As the thermometer often sinks to forty and fifty degrees below zero (Fahrenheit), the mills and the water used in them have to be warmed. This is generally done by the use of steam. Along the ground-floor, in front of the apron plates, there runs a sheet-iron drum, 18 inches in diameter, through which the waste steam of the engine is conducted. The battery-water is prevented from freezing by steam coils passing through the supply-tanks.

Fire-plugs, with the necessary hose attachments, are placed at regular intervals, to be used in case of accident.

To reduce the cost of repairs and renewals, which is so large a part of the expenses of gold-milling, the Homestake company has a foundry, where the rock-breaker shoes and dies, pitmans and toggle-plates, mortars and dies, boss-heads, tappets, thimbles for props, cams and hubs of cam-shaft pulleys, and all shaft-boxes, are cast, from No. 1 and No. 3 foundry iron and worn-castings. These are also sometimes bought at one cent a pound. The casting is all done in sand, with the exception of the rock-breaker shoes and dies and the faces of the battery-dies, which are chilled.

In the machine shop, which is a very complete establishment, all the necessary repairs are made. This is the only good shop in the district, and does the necessary work for outside companies also.

V. THE MILLS IN DETAIL.

The six mills under the Homestake management (that is, all the mills here described, except the Caledonia) have the same patterns for all parts needing frequent renewal. This greatly reduces the amount of material kept on hand and the labor and cost of repairs.

Grizzlies.—These are coarse screens, upon which the ore, arriving from the mine, is dumped and separated, the screened fines dropping directly into the bins. This relieves the breaker of ore that does not need to be crushed, and only the coarse ore has to be shovelled into it. They are 3 to 4½ feet wide, 10 to 14 feet long, and set at an angle of about 40 degrees, representing a rise of ¼ inches per foot. They are made generally of wrought iron bars, 1 inch wide and 2 to 4 inches deep, held in place, 1½ to 2 inches apart, by three or four, sometimes five, 1-inch iron rods, provided with washers at the proper intervals. Mr. Bowie gives 2,040 pounds as the weight of a grizzly at the Father de Smet mill, 4½x12 feet in size, with 24 bars, 1 inch wide by 2 inches deep, and 1½ inches apart. The grates last about four years. In some instances old wrought-iron rails, with base turned up, take the place of the standard rectangular bars; but they do not last much over one year.

Rock-Breakers.—All the Homestake mills use the Blake. The coarse ore, rolling down from the grizzlies, collects on the crusher-floor, and is fed by hand into the mouth of the breaker on the same level. From the crusher, it passes into the bins which have already received the fine ore from the grizzlies. The No. 5 breaker used (the largest pattern in the market) has a receiving capacity of 9 by 15 inch, is set to crush from 1½ to 1¾ inches, and is run twenty hours out of the twenty-four, each crusher being calculated to serve twenty stamps. The amount crushed per day is not known, as there is no easy way of determining how much of the ore in the bins has passed through the crusher. If one-fourth of the ore (a probable proportion in view of the slaty character of the ore) passes through the screens, escaping the breaker, and if 20 stamps crush 90 tons of Homestake ore in

24 hours, the amount crushed in 20 hours by one crusher is 67½ tons, or 3.4 tons per hour. This small figure, as compared with the capacity of the crusher, which is given at 7 tons, is due to the smallness of the mouth of the crusher, which necessitates the breaking up of the ore—a serious matter occasioning much delay. No part of the mill-work is so laborious as this breaking and feeding of the ore, which has to be done by hand.

The wear and tear of material in a crusher is comparatively small, a shoe lasting two months, a die four months.

The small receiving capacity of the No. 5 Blake is a marked disadvantage to it, in comparison with the Gates crusher, lately introduced at the Caledonia. The ore of the Caledonia mine breaks rather coarse (that is, it does not show much of the slaty character of the Homestake ore), and is dumped immediately into the hopper of the crusher without use of the grizzly. With about the same horse-power as three No. 5 Blakes, and set to the same size, one No. 6 Gates crusher (with three receiving openings, each 12 by 18 inches), attended by one man only, crushes 200 tons in ten hours. When the three Blakes were in use, it required 20 hours and 5 men to produce the same result. Mr. T. L. Skinner, the superintendent, says in his last report that this new crusher saves him \$27 a day. In order to make the iron head last longer, he uses three sets of concaves of graduated thickness, the thinnest first, and so on. When, after some time, the head and first set of concaves have become so worn away as to increase the width of the discharge above 1½ in., the second set is introduced; and, when they in turn wear thin, the third. By the time these are worn down (after about five months), it becomes necessary to replace the head. The disadvantage of the Gates crusher is its enormous weight (No. 6 weighs 30,000 lbs.), and the consequent difficulty of transporting it, especially in some mining regions.

The best arrangement for a large mill seems to be to use a still larger Gates crusher (No. 8, with receiving openings 18 by 48 in.), set to crush coarse, and discharging into two No. 6 crushers, set to crush fine. Thus the largest pieces of rock any man could handle would pass directly into the crusher, and the breaking by hand in mine and mill would be reduced to a minimum.

The smaller Gates crushers, with correspondingly small mouths, are not to be preferred to the Blake crushers.

Ore-Bins.—These receive the ore from the grizzlies and crushers, directly over them, and discharge it through chutes into the hoppers of the feeders. They are triangular, with one vertical side, facing the battery and reaching down to the cam-floor. Just above the latter, are the openings (one for each feeder) through which the ore passes downward into the chutes, terminating in the hoppers of the feeders. The quantity of the discharge is regulated by a sliding door. In a double mill, the inclined bottoms of the two bins diverge, leaving an open space between them which has the shape of an inverted V. This arrangement of bins is common to all the mills except the Father de Smet.

The bottoms of the bins, 3 inch thick, are made of 1 inch board, running lengthwise, with 2 inch plank, placed at right angles upon it crosswise. The bottom and sides are carefully braced with strong beams. There are no separate compartments or special arrangements for directing the ore towards the discharge-openings. The descending ore soon wears out such contrivances. It is advisable to line with

iron the upper part of the bottom, on which the ore drops from the grizzlies and crushers. Otherwise, it wears out much faster than the middle and lower parts, which lasts five to six years.

It is best to make ore-bins as large as practicable, so that, in case of accident in mine or at rock-breakers, the mill need not stop. The capacity ought never to be less than one full day's supply. By multiplying in each of the three double mills, the horizontal distance between the two sets of batteries into the vertical distance between crusher-floor and cam-floor, the comparative size of their ore-bins can be approximately estimated. The following table shows the result. It is assumed that the distance between front of bin and battery, as well as the incline of the bin, is about the same in all.

TABLE IV.—Comparative Capacity of Ore Bins.

Name of Mill.	Horizontal distance.	Height.	Product.
	feet.	feet.	square feet.
Homestake	44.5	14.25	634
Golden Star	36.0	23.75	855
Highland	46.0	22.75	1046

This would show that, of these three double mills in which the batteries are arranged back to back, the Highland has the largest bin-capacity. In the Father de Smet, where the batteries discharge towards the centre, the bins, built entirely above the batteries, and extending to the side-walls of the building, have a still larger capacity, the figures, corresponding to the dimensions given above, being 57 feet by 30 feet, or 1,710 square feet. There are, however, decisive objections on other grounds to this arrangement. The apron-plates are so overshadowed by the inclined bottoms of the ore-bins above that the facility of supervision, claimed as one advantage of this plan, is largely neutralized by the prevailing darkness, even at noonday.

Feeders.—The working capacity of a battery, and its exemption from unnecessary wear and tear, depend greatly on regular and equal feeding of ore. This used to be done by hand, but is now generally accomplished by automatic feeders, placed at the back of the batteries, and discharging either directly into the feed-opening of the mortar (the lip of the feeder reaching into the mortar-feed), or, as at the Caledonia, upon a small inclined iron-lined apron which leads to the mortar. By the latter arrangement a little more room is left between feeder and mortar, and the feed-opening can be narrower and longer, and the ore more uniformly distributed under the stamps. Thus, the Homestake mortar feed-opening is 24 in. long and 4½ in. wide, while that of the Caledonia, occupying the entire length of the mortar, is 52 in. long and only 3 in. broad.

The two ore-feeders, used in the district, are the "Heady Challenge" and the "Tulloch Automatic." Each has a well-earned good name, the Challenge being, perhaps, more desirable for wet ores. Both right-hand and left-hand feeders are used, the bumper-rod standing between stamps 1 and 2 or 4 and 5. The Challenge feeders, introduced with the new 20 stamps of the Caledonia mill, are central feeders, the bumper-rod being placed next to the central stamp. The rod is guided from the cam-floor,

to which a piece of board, with suitable hole for the rod to pass through, is fastened.

The comparative advantages of the two feeders may be summed up by saying that, while the sheet-iron plate below the hopper of the Tulloch wears out quickly (with Homestake ore in two years), it is cheap and can be patched or renewed by any blacksmith; while the circular cast-iron carrier table of the Challenge lasts seven years with the same ore, but is costly, and, if anything is out of order with the gearing, it requires a shop and a machinist.

Battery-Foundations, Frames and Guides.—The essential importance of a good foundation is well known. In preparing it, a rectangular pit, from 11 to 14 ft. deep, is first dug to receive the mortar-block. It is made sufficiently long and wide (4 by 6½ ft.) to leave a space of about 24 inches all around the block. The bottom is then carefully levelled and some sand tamped down. On this are placed two layers of 2-inch plank, spiked crosswise to each other, and then the planks which form the mortar-block. The latter used to be placed directly on the bottom of the pit, the uneven tops being sawed off afterward. Now, care is taken that this 4-inch wooden floor shall be accurately horizontal, and that the distance between it and the bottom of the mortar shall have the length of the mortar-block. The top of the block is only planed off, which saves time. By the use of this flooring, the time required for replacing a mortar-block is reduced from six or seven days to five. The mortar-block consists of planks, from 11 to 14 ft. long (according to the depth of the pit), of varying breadth, and not more than 2 or 3 in. thick, as it is difficult to find wood of greater thickness which is sound throughout. They are spiked together, and are fastened above and below with binders, bolted to each other by transverse rods, the upper binders (8 by 12 in.) being even with the top of the mortar-block, and the lower binders (12 by 12 in.) 3 ft. lower down. The space around the mortar-block is then carefully filled and tamped with rock tailings up to the level of the mud sills, which are about 4 ft. below the bottom of the mortar. When the top of the mortar-block has been planed off and levelled, a sheet of rubber cloth, ¼ in. thick, is placed over it, and the mortar put in place. Through the four holes in the flanges on each side pass eight bolts, from 3 ft. to 4 ft. 6 in. long, and from 1½ to 1½ in. in diameter, with which the mortar is fastened to the block.

In placing the planks forming the mortar-blocks, and in adjusting the bolts that hold down the mortar, a decided improvement has lately been made at the Homestake mills. The planks which always stand upon end were formerly so spiked that their width was parallel to the short side of the mortar. The holes for the eight bolts were then bored into the mortar-block from above; at a suitable distance below, recesses were chipped out to receive the nuts which secure the lower ends of the bolts. Now the planks are so placed that their width is parallel to the long side of the mortar. The bolts have only at their upper end a thread, and end in a loop at the bottom. Through these loops and through the mortar-block, pass horizontally 2-inch iron rods. The planks, on the two sides of the block, where the bolts pass down, are cut out to receive them. The advantages of this arrangement are apparent. In addition to the mortar being more securely and evenly tied to the block, it is easier to renew the mortar-block if necessary. The pit need only be dug in front of the mortar, and when the front binders have been removed, it is easy to tear out the planks, one after another, with

pick and adze. In putting in the new block, the two outside rows of planks, with places cut to receive bolts, are kept ready, so that only four horizontal 2½-inch holes for the rods need be bored when the planks have been spiked together. With the old method, two trenches had to be dug, instead of one, if a mortar-block was to be exchanged. Then the planks had to be chipped out in pieces until room enough had been made for them to be torn off. This cost much labor and time.

Battery Frames.—These are generally 12 by 24 inches in size, with recesses for the boxes of the cam-shaft. They are placed on the short sides of the mortar, and are independent of the mortar-block, standing on the cross-sills (which are placed on top of, and at right angles to, the mud-sills), and tied by the upper and lower guide-timbers, and, at the foot, by two longitudinal beams, bolted to them, and let into the cross-sills. The frames are braced either from the back or the front of the battery, according to the way in which the power is transmitted to the cam-shaft. In the Homestake, Highland, Golden Terra and Father de Smet mills, where the line-shafts are at the back of the battery, the frames are braced by posts, generally placed on an incline between frame and cross-sill, leaving the entire front of the battery unobstructed. In the Golden Star and Caledonia mills, the cam-shafts receive their motion from line-shafts placed on the cam floor, and the frames are braced against the cross-beams to which the boxes of the line-shafts are bolted.

Guides.—The stamps are held upright by two sets of guides, fastened to the guide-timbers which tie the battery-frames. The upper guides are above the tappets, the lower ones between the cam-shaft and the top of the mortar. At the Homestake mill, the center of the lower guides is 17½ inches above the top of the mortar, and the cam-shaft, revolving between the two sets of guides, is 3 ft. 10½ in. below the center of the upper, and 4 ft. above the center of the lower guides, making the total distance between the two sets 7 ft. 10½ in. At the Caledonia mill, the distance from top of mortar to center of lower guides is 16½ in.; from these to center of cam shaft, 3 ft. 4½ in.; from this to center of upper guides, 4 ft. 2½ in.; total, 7 ft. 6¾ in.

Each set of guides consists of two pieces of 4-in. pine plank, 16 in. deep, having semi-circular grooves, through which the stems of the stamps pass. Between the two parts of the guides, when new, are inserted small pieces of wood to hold them slightly apart. When the grooves are somewhat worn, these slats are removed, and the guides brought nearer each other. Later on, the faces are planed off to diminish the size of the grooves, so that the stamps may not be held too loosely. Each set of guides is secured to the guide-timber with eight ¾-in. bolts. The grooves in the guides are lubricated with a preparation of black lead and linseed oil, mixed warm in such proportions as to form a soft paste. Oak guides last eighteen months; pine, only four months.

Mortars.—Two kinds of single discharge mortars are used in the district. Each consists of one solid casting. The bottom and sides are so thick as not to need any lining, this thickness decreasing very considerably as the feed is approached. The outside walls are vertical, with the exception of the discharge, which projects somewhat. The top is closed by two pieces of 2-in. plank, which rests on logs, ¾ in. wide, cast in the mortar, 2 in. below the top. These planks have each five semi-circular recesses which, when placed together, form holes

for the passage of the stems. In addition to these five large holes, two smaller ones are bored for the two 1-in. water-supply pipes, placed between stamps 1 and 2 and 4 and 5. Two mortars are placed close together as the stamps of both are set in motion by one cam-shaft. In order to reach the mortars, etc., a passage-way is left between every two pairs of batteries. The water-supply is derived from a 3-in. main, running along the front of the batteries. From it passes upward a 2-in. pipe between each pair of batteries. With this is connected a 2-in. horizontal pipe, from which four 1-in. pipes branch off at right angles, two for each mortar. In addition to this water-supply, there is a 1-in. pipe at each passage-way, close to the mortar, coming from the 3-in. main. A hose is attached to clean the apron-plates and for other purposes.

The points of difference between the two mortars lie in the inside dimensions of the lower part of the mortar and in the arrangement and number of the inside amalgamated copper plates,

1. The Homestake mortar (Figs. 1, 2 and 3), weighing 5400 pounds, is 54½ in. high and 54¾ in. long. The feed-opening, beginning 6½ in. below the top, is 24 in. long, 4½ in. wide and 7 in. deep. On entering the mortar it remains 24 in. long and 7 in. deep. At the bottom of the feed, forming the continuation of the incline over which the ore passes into the mortar, is a lip, 4¾ in. wide and 1¼ in. thick, designed to discharge the ore against the upper half of the stamp-head. The lower edge of the lip is 14 in. above the inside bottom of the mortar. As the lip wears out fast it might be well to cast it thicker, as has been done in the Caledonia mortar. Taking the front view of the mortar, we find, 15½ in. from the bottom, the discharge-opening 48½ in. long and 21¾ in. high. The frame is inclined outward about 10 degrees from the vertical. On the short side of the discharge-opening, are grooves to receive the chuck-block, screen-frame and curtain, which are held in place by keys and sockets. The chuck-block is also fastened at the bottom by two horizontal keys, supported by lugs on the outside lip of the mortar below the discharge. Viewing the mortar in cross-section, we first have the two bottom flanges, 3 in. high and 5 in. broad. The bottom of the mortar (the mortar-bed) is 7½ in. thick, the sides, at the foot of the dies, 3½ in. The inside dimensions are: Width at the bottom, 10½ in.;* length, 50 in.; height to issue of mortar (not of pulp), 8¾ in.; width at this point, 13½ in.; at the top of discharge opening, 20 in.; at the top of mortar, 16 in.; total inside height, 47 in. The casting is ¾ in. thick, from the top down to the feed-opening, on three sides, the back being a little thicker.

A mortar lasts four years, wearing pretty uniformly at the sides and back.

2. The Caledonia mortar weighs 5,700 pounds, is 57½ inches high and 54 inches long. The feed-opening, beginning 15½ inches from the top, is 3 inches wide, 11 inches deep and extends the entire length of the mortar, having a strengthening rib in the centre. At entering the mortar, it is 50½ inches long and 7½ inches deep. Here the lip, 2½ inches thick and 8 inches wide, measured on the incline, begins. The bottom of the lip is 15 inches from the foot of the dies. As in the Homestake mortar, the ore is discharged towards the head of the stamp. The lip serves also as a protector to the amalgamated copper plate below it. The discharge-opening in front, 50 inches long by 17 inches high, begins 20 inches above the bottom of the flange.

*Formerly the width was 14 inches, but in order to increase the crushing capacity, it was reduced.

Its frame is also inclined outward about 10 degrees from the vertical. The grooves on the sides, receiving only the screen-frames and the curtain, are simpler in construction than those of the Homestake mortar. The lugs for the horizontal keys are the same. Taking the cross section, we find the flanges 3 inches thick and $4\frac{1}{2}$ inches wide. The mortar-bed is 7 inches thick, the sides, at the foot of the dies, $4\frac{1}{2}$ in. The inside dimensions are: Width at the bottom, 10 in.; length, $50\frac{1}{2}$ in.; height, 14 in. to the issue of mortar and pulp, where the width is 16 inches. This increases to 19 inches at the top of the discharge. The top of the mortar is $13\frac{1}{2}$ inches wide, and the total inside height $50\frac{1}{2}$ inches. The casting, from the top down to the feed-opening, is $\frac{3}{4}$ inch thick.

A mortar lasts six years, and wears out more on the short sides than at the back.

In comparing the two types, we see that they differ in the feed-opening, as already discussed. The feeding-lip also differs, that of the Caledonia mortar being thicker and wider than the other. The increase of width is necessitated by the presence of the amalgamated copper-plate below the lip; the mortar itself is also wider at the issue for the same reason. The depth of the Homestake mortar is $8\frac{3}{4}$ inches, and that of the Caledonia mortar 14 inches.

(To be Continued.)

Dr. FRANCIS WYATT.
SPECIALTIES:
Sulphuric Acid, Fertilizers
And PHOSPHATES.
24 PARK PLACE,
NEW YORK.



MONEY ORDERS.

MONEY ORDERS may be obtained at any Money Order Office in Canada, payable in the Dominion and Newfoundland; also in the United States, the United Kingdom, France, Germany, Austria, Hungary, Italy, Belgium, Switzerland, Portugal, Sweden, Norway, Denmark, the Netherlands, India, Japan, the Australian Colonies, and other countries and British Colonies generally.

On Money Orders payable within Canada the commission is as follows:

If not exceeding \$4.....	2c.
Over \$4, not exceeding \$10.....	5c.
" 10, " " 20.....	10c.
" 20, " " 40.....	20c.
" 40, " " 60.....	30c.
" 60, " " 80.....	40c.
" 80, " " 100.....	50c.

On Money Orders payable abroad the commission is:

If not exceeding \$10.....	10c.
Over \$10, not exceeding \$20.....	20c.
" 20, " " 30.....	30c.
" 30, " " 40.....	40c.
" 40, " " 50.....	50c.

For further information see OFFICIAL POSTAL GUIDE.

Post Office Department, Ottawa,
1st November, 1889.

BURN, NORRIE & CO., *Locators of Precious Metals*

— AND —
**DEALERS IN MINERAL LANDS,
COBOURG, ONT.**

W. D. BURN.

P. O. BOX 198.

DAVID NORRIE.



SEALED TENDERS addressed to the undersigned, will be received at this Office until Wednesday, 4th December, for the Clearing and Removal of Snow, &c., from the Parliamentary and Departmental Buildings and Grounds, Ottawa, for the clearing and removal of snow from the Langevin Block, Museum, Printing Bureau, &c., Ottawa, and also for the removal of snow, &c., from the roofs of buildings, out-buildings, walks, avenues or roads, &c., &c., at Rideau Hall.

Forms of Tender and Specifications can be had at this office, where all necessary information can be obtained.

Separate Tenders will be required for each work, and must be endorsed "Tender for Removal of Snow, Parliamentary Buildings," "Tender for Removal of Snow, Langevin Block, &c.," and "Removal of Snow, Rideau Hall," respectively.

An accepted bank cheque payable to the order of the Minister of Public Works, equal to five per cent. of amount of tender, must accompany each tender. This cheque will be forfeited if the party decline the contract or fail to complete the work contracted for, and will be returned in case of non-acceptance of tender.

The Department does not bind itself to accept the lowest or any tender.

By order,

A. GOBEIL,
Secretary.

Department of Public Works,
Ottawa, 26th Nov., 1889.

Gold Mining Supplies.

The principal depot in Nova Scotia, carrying the most complete assortment of first class goods, is

H. H. FULLER & CO'S,
41 to 45 Upper Water St., Halifax, N.S.

Our line comprises Explosives, Fusc, American and English Mill and Hammer Steel, Bar and Bolt Iron, Steel Wire Hoisting Rope, Hemp and Manilla Rope, Rubber and Leather Belting, Miners' Candles, Oils and Lamps, Miners' Tools, Machinists' Tools, Blacksmiths' Tools, and every requisite for the gold miner.

H. H. FULLER & CO.,
Halifax, N.S.

LEDOUX & COMPANY,

10 CEDAR ST., NEW YORK,

**Engineers, Metallurgists &
Assayers.**

Public Ore Sampling & Storage Works

All the principal buyers of furnace materials in the world purchase and pay cash against our certificates of assay, through New York banks.

By special permission of the Secretary of the Treasury of the United States, cars of ore or copper matte passing through in bond can be opened and sampled at our works.

Consignments received and sold to highest bidder. Send for circular giving full particulars.

**Mines examined and sampled. Assays and
Analyses of all kinds.**

ALEX. RANKIN,

20 Toronto Street, Toronto Ont.

Agent for sale of Mines and Mineral Lands

CORRESPONDENCE SOLICITED.

Agents in England and New York.

CHEMICAL APPARATUS! OF EVERY DESCRIPTION.



Glass, Porcelain, Stoneware, Platinum Crucibles of every sort, Analytical Scales and Weights, Fine Chemicals and Reagents, including Volumetric Solutions. Every requisite for Analysis or Experiment. For Sale by

LYMAN, SONS & CO.,
384 St. Paul St., Montreal.

Illustrated Catalogue mailed on receipt of
10c. or Business Card.

ASBESTOS.

THEO. HAMEL,

44 Mountain Hill, Quebec,

SOLE ASBESTOS MANUFACTURER in CANADA

Write for prices and catalogue. Use Asbestos and save your money. Applied on boilers and Steam pipes it will prevent them from rusting and will economize 33% on fuel

SPECIALIST IN MICA MINER'S AGENT

RICHARD BAKER,

6 & 7 Cross Lane, - London, Eng.

MINERS OF NOVA SCOTIA!

W. & A. MOIR,

MECHANICAL

**Engineers and Machinists,
HALIFAX.**

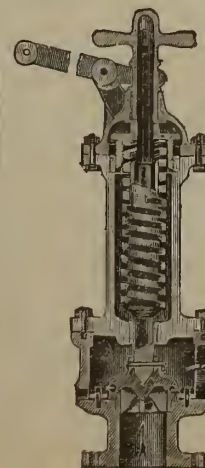
Manufacturers of

Mill and Mining Machinery,
Air and Circulating Pumps,

Hand and Power Elevators,

Marine & Stationery Engines,
And Brass and Iron Castings

of every description.



MACDONALD & CO., Limited,

—MANUFACTURERS AND DEALERS IN—

PUMPING MACHINERY, IRON PIPES, FITTINGS, &c., FOR MINERS' USE.

Call or Write us for Prices.

HALIFAX, N.S.



SEALED TENDERS addressed to the undersigned, and endorsed "Tender for Vault," will be received until Thursday, the 5th day of December, inclusively, for the construction of an Iron and Steel Vault in the Eastern Departmental Building, Ottawa, according to a specification to be seen at the Department of Public Works, Ottawa.

An accepted bank cheque payable to the order of the Minister of Public Works, equal to five per cent. of amount of tender must accompany each tender. This cheque will be forfeited if the party decline the contract, or fail to complete the work contracted for, and will be returned in case of non-acceptance of tender.

The Department does not bind itself to accept the lowest or any tender.

By order,

A. GOBIEL,
Secretary.

Department of Public Works,
Ottawa, 14th Nov., 1889.

PROPERTIES FOR SALE.

Parties having developed or undeveloped mineral lands for sale will find the REVIEW an admirable medium for bringing them before the notice of CAPITALISTS and INVESTORS in GREAT BRITAIN and the UNITED STATES.

BEACOCK & CO., - - BROCKVILLE, ONT.



—Manufacturers of—

Rawhide, Artificial Limbs & Splints

Patented in the United States and Canada. Send for prices.

Gold Mining Machinery.



I. MATHESON & CO.,

Engineers and Boilermakers,

NEW GLASGOW, N.S.

TAURO FOUNDRY AND MACHINE CO.

TRURO, N.S.

Engineers & Founders

OUR SPECIALTIES

— ARE —

Gold Mining Machinery

Of every kind, with latest Western Improvements.

ROTARY SAW MILLS

In Latest Styles.

ALSO MANUFACTURERS OF
BOILERS & ENGINES

Iron, Bridges, Stoves,

SHIP, MILL and GENERAL
CASTINGS.



G. CLISH,
Manager.

D. McDONALD,
Supt.

S. R. TUPPER,
Sec'y and Treas.

WM. STAIRS, SON & MORROW,

174 to 190 Lower Water St., Halifax, N.S.,

Importers and Dealers in all kinds of Mining Supplies, Steel Wire Ropes,

LUBRICATING OILS, EXPLOSIVES, &c. &c.

Correspondence solicited. Goods promptly supplied. Sole agent for Canada for Patent Mineral Fusible Cement.



PROVINCE OF NOVA SCOTIA.

Leases for Mines of Gold, Silver, Coal, Iron, Copper, Lead, Tin

— AND —

PRECIOUS STONES.

Titles given direct from the Crown, Royalties & Rentals moderate

GOLD AND SILVER.

Under the provisions of chap. 7, Revised Statutes, of Mines and Minerals Licenses are issued for prospecting Gold and Silver for a term of six months, which can be extended by renewal for another six months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. Up to five areas the cost is 50 cents per area, for every area in addition 25 cents. Cost of renewal one half the original fees. Leases of any number of areas are granted for a term of 21 years. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents annually for each area contained in the lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at \$19.00 an ounce, and in smelted Gold valued at \$18.00 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province he may stake out the boundaries of the area he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for twelve months are issued, at a cost of twenty dollars, for Minerals other than Gold and Silver, out of which one square mile can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department free of charge, and provision is made for lessees and licensees whereby they can acquire promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties makes the royalties a first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists who have always stated that the Mining Laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are :—Copper, four cents on every unit ; Lead, two cents upon every unit ; Iron, five cents on every ton ; Tin and Precious Stones, five per cent. ; Coal, 7½ cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

THE HON. C. E. CHURCH,

Commissioner Public Works and Mines,

HALIFAX,

NOVA SCOTIA.



DEPARTMENT OF Inland Revenue.

AN ACT RESPECTING AGRICULTURAL FERTILIZERS.

The public is hereby notified that the provisions of the Act respecting AGRICULTURAL FERTILIZERS came into force on the 1st of January, 1886 and that all Fertilizers sold thereafter require to be sold subject to the conditions and restrictions therein contained—the main features of which are as follows:

The expression "fertilizer" means and includes all fertilizers which are sold at more than TEN DOLLARS per ton, and which contains ammonia, or its equivalent of nitrogen, or phosphoric acid.

Every manufacturer or importer of fertilizers for sale, shall, in the course of the month of January in each year, and before offering the same fertilizer for sale, transmit to the Minister of Inland Revenue, carriage paid, a sealed glass jar, containing at least two pounds of the fertilizer manufactured or imported by him, with the certificate of analysis of the same, together with an affidavit setting forth that each jar contains a fair average sample of the fertilizer manufactured or imported by him; and such sample shall be preserved by the

Minister of Inland Revenue for the purpose of comparison with any sample of fertilizer which is obtained in the course of the twelve months then next ensuing from such manufacturer or importer, or collected under the provisions of the Adulteration Act, or is transmitted to the chief analyst for analysis.

If the fertilizer is put up in packages, every such package intended for sale or distribution within Canada shall have the manufacturer's certificate of analysis placed upon or securely attached to each package by the manufacturer; if the fertilizer is in bags, it shall be distinctly stamped or printed upon each bag; if it is in barrels, it shall be either branded, stamped or printed upon the head of each barrel or distinctly printed upon good paper and securely pasted upon the head of each barrel, or upon a tag securely attached to the head of each barrel; if it is in bulk, the manufacturer's certificate shall be produced and a copy given to each purchaser.

No fertilizer shall be sold or offered or exposed for sale unless a certificate of analysis and sample of the same shall have been transmitted to the Minister of Inland Revenue and the provisions of the foregoing sub-section have been complied with.

Every person who sells or offers or exposes for sale any fertilizer, in respect of which the provisions of this Act have not been complied with—or who permits a certificate of analysis to be attached to any package, bag or barrel of such fertilizer, or to be produced to the inspectors to accompany the bill of inspection of such inspector, stating that the fertilizer contains a larger percentage of the constituents mentioned in sub-section No. 11 of the Act than is contained therein—or who sells, offers or exposes for sale any fertilizer purporting to have been inspected, and which does not contain the percentage of constituents mentioned in the next preceding section—or who sells or offers or exposes for sale any fertilizer which does not contain the per-

centage of constituents mentioned in the manufacturer's certificate accompanying the same, shall be liable in each case to a penalty not exceeding fifty dollars for the first offence, and for each subsequent offence to a penalty not exceeding one hundred dollars. Provided always that deficiency of one per centum of the ammonia, or its equivalent of nitrogen, or of the phosphoric acid, claimed to be contained, shall not be considered as evidence of fraudulent intent.

The Act passed in the forty-seventh year of Her Majesty's reign, chaptered thirty-seven and entitled, "*An Act to prevent fraud in the manufacture and sale of agricultural fertilizers*," is by this Act repealed, except in regard to any offence committed against it or any prosecution or other act commenced and not concluded or completed, and any payment of money due in respect of any provision thereof.

A copy of the Act may be obtained upon application to the Department of Inland Revenue, as well as a copy of a Bulletin which it is proposed to issue in April, 1888, concerning the fertilizers

E. MIALL,
Commissioner.

January, 1889.



NOTICE

Is hereby given that all communications in respect to matters affecting the Department of Indian Affairs should be addressed to the Honorable E. Dewdney as Superintendent General of Indian Affairs, and not as Minister of the Interior, or to the undersigned. All Officers of the Department should address their official letters to the undersigned.

L. VANKOUGHNET,
Deputy Superintendent-General
of Indian Affairs.

Department of Indian Affairs,
Ottawa, 11th May, 1889.



Intercolonial Railway OF CANADA.

The direct route between the West and all points on the Lower St. Lawrence and Baie des Chaleurs, Province of Quebec; also for New Brunswick, Nova Scotia, Prince Edward and Cape Breton Islands, Newfoundland and St. Pierre.

EXPRESS TRAINS leave Montreal and Halifax daily (Sunday excepted) and run through without change between these points in 30 hours.

The Through Express Train cars of the Intercolonial Railway are brilliantly lighted by electricity and heated by steam from the locomotive, thus greatly increasing the comfort and safety of travellers.

New and Elegant Buffet Sleeping and Day Cars are run on all through Express Trains.

CANADIAN EUROPEAN MAIL AND PASSENGER ROUTE.

Passengers for Great Britain or the Continent by leaving Montreal on Friday morning will join Outward Mail Steamer at Halifax the same evening.

The attention of shippers is directed to the superior facilities offered by this route for the transport of flour and general merchandise intended for the Eastern Provinces and Newfoundland; also for shipments of grain and produce intended for the European market.

Tickets may be obtained and all information about the route, also Freight and Passenger rates, on application to

G. W. ROBINSON,
Eastern Freight and Passenger Agent,
136½ St. James St., MONTREAL.

E. KING,
Ticket Agent,
27 Sparks Street,
OTTAWA.

D. POTTINGER,
Chief Superintendent.

Railway Offices, Moncton, N.B.
14th November, 1889.

The Polson Iron Works Co'y TORONTO, ONT.

Manufacturers of the Celebrated "Brown Automatic Engine."

GENERAL DEALERS IN

MINING MACHINERY.

SPECIAL AGENTS FOR

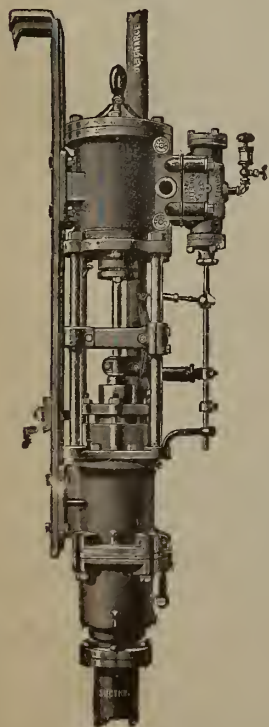
Knowles' Steam Pumps,

B. T. Sturtevant's Blowers and Fans,

Burleigh Rock Drills.

Hoisting Engines and Boilers, Quartz Mills, Diamond Prospecting Drills, Rock Breakers.

Office and Works. Esplanade E.; Warehouse, 38 Yonge St., - * TORONTO.



THE DOMINION WIRE ROPE CO.

MANUFACTURERS OF



Works at LACHINE.

For Hoisting, Mining, Transmission of Power, Towing
Ship Rigging, Guys, etc.,

ALSO

Lang's Patent Wire Rope for Transmission and Colliery Purposes.
JAMES COOPER, Agent, Montreal.**RUSSELL & CO.**

PROVINCIAL AND DOMINION

LAND SURVEYORS,
CIVIL AND MINING ENGINEERS,
PORT ARTHUR, ONTARIO.

Mining Properties Surveyed, Reported on and Dealt in

Latest and Most Complete Plans of Thunder Bay
Mining District Always on Hand.A. L. RUSSELL, A. H. MACDOUGLL, W. W. RUSSELL
P. L. S., D. L. S. P. L. S., D. L. S. M. E. A. M. C. A. N. S. O. C. C. E.**Mining Regulations**

TO GOVERN THE DISPOSAL OF

Mineral Lands other than Coal Lands, 1886.

THESE REGULATIONS shall be applicable to all Dominion Lands containing gold, silver, cinnabar, lead, tin, copper, petroleum, iron or other mineral deposits of economic value, with the exception of coal.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein, either by surface or subterranean prospecting for mineral deposits, with a view to obtaining under the Regulations a mining location for the same but no mining location or mining claim shall be granted until the discovery of the vein, lode or deposit of mineral or metal within the limits of the location or claim.

QUARTZ MINING

A location for mining, except for iron on veins, lodes or ledges of quartz or other rock in place, shall not exceed forty acres in area. Its length shall not be more than three times its breadth, and its surface boundary shall be four straight lines, the opposite sides of which shall be parallel, except where prior locations would prevent, in which case it may be of such a shape as may be approved of by the Superintendent of Mining.

Any person having discovered a mineral deposit may obtain a mining location therefor, in the manner set forth in the Regulations which provides for the character of the survey and the marks necessary to designate the location on the ground.

When the location has been marked conformably to the requirements of the Regulations, the claimant shall within sixty days thereafter, file with the local agent in the Dominion Land Office for the district in which the location is situated, a declaration or oath setting forth the circumstances of his discovery, and describing, as nearly as may be, the locality and dimensions of the claim marked out by him as aforesaid; and shall, along with such declaration, pay to the said agent an entry fee of FIVE DOLLARS. The agent's receipt for such fee will be the claimant's authority to enter into possession of the location applied for.

At any time before the expiration of FIVE years from the date of his obtaining the agent's receipt it shall be open to the claimant to purchase the location on filing with the local agent proof that he has expended not less than FIVE HUNDRED DOLLARS in actual mining operations on the same; but the claimant is required, before the expiration of each of the five years, to prove that he has performed not less than ONE HUNDRED DOLLARS' worth of labor during the year in the actual development of his claim, and at the same time obtain a renewal of his location receipt, for which he is required to pay a fee of FIVE DOLLARS.

The price to be paid for a mining location shall be at the rate of FIVE DOLLARS PER ACRE, cash, and the sum of FIFTY DOLLARS extra for the survey of the same.

No more than one mining location shall be granted to any individual claimant upon the same lode or vein.

IRON.

The Minister of the Interior may grant a location for the mining of iron, not exceeding 160 acres in area which shall be bounded by north and south and east and west lines astronomically, and its breadth shall equal its length. Provided that should any person making an application purporting to be for the purpose of

mining iron thus obtain, whether in good faith or fraudulently, possession of a valuable mineral deposit other than iron, his right in such deposit shall be restricted to the area prescribed by the Regulations for other minerals, and the rest of the location shall revert to the Crown for such disposition as the Minister may direct.

The regulations also provide for the manner in which land may be acquired for milling purposes, reduction works or other works incidental to mining operations.

Locations taken up prior to this date may, until the 1st of August, 1886, be re-marked and re-entered in conformity with the Regulations without payment of new fees in cases where no existing interests would thereby be prejudicially affected.

PLACER MINING.

The Regulations laid down in respect to quartz mining shall be applicable to placer mining as far as they relate to entries, entry fees, assignments, marking of localities, agents' receipts, and generally where they can be applied.

The nature and size of placer mining claims are provided for in the Regulations, including bar, dry, bench, creek or hill diggings, and the RIGHTS AND DUTIES OF MINERS are fully set forth.

The Regulations apply also to

BED-ROCK FLUMES, DRAINAGE OF MINES AND DITCHES.

The GENERAL PROVISIONS of the Regulations include the interpretation of expressions used therein; how disputes shall be heard and adjudicated upon; under what circumstances miners shall be entitled to absent themselves from their locations or diggings, etc., etc.

THE SCHEDULE OF MINING REGULATIONS

Contains the forms to be observed in the drawing up of all documents such as:— "Application and affidavit of discoverer of quartz mine." "Receipt for fee paid by applicant for mining location." "Receipt for fee on extension of time for purchase of a mining location." "Patent of a mining location." "Certificate of the assignment of a mining location." "Application for grant for placer mining and affidavit of applicant." "Grant for placer mining." "Certificate of the assignment of a placer mining claim." "Grant to a bed rock flume company." "Grant for drainage." "Grant of right to divert water and construct ditches."

Since the publication, in 1884, of the Mining Regulations to govern the disposal of Dominion Mineral Lands the same have been carefully and thoroughly revised with a view to ensure ample protection to the public interests, and at the same time to encourage the prospector and miner in order that the mineral resources may be made valuable by development.

COPIES OF THE REGULATIONS MAY BE OBTAINED UPON APPLICATION TO THE DEPARTMENT OF THE INTERIOR

A. M. BURGESS,

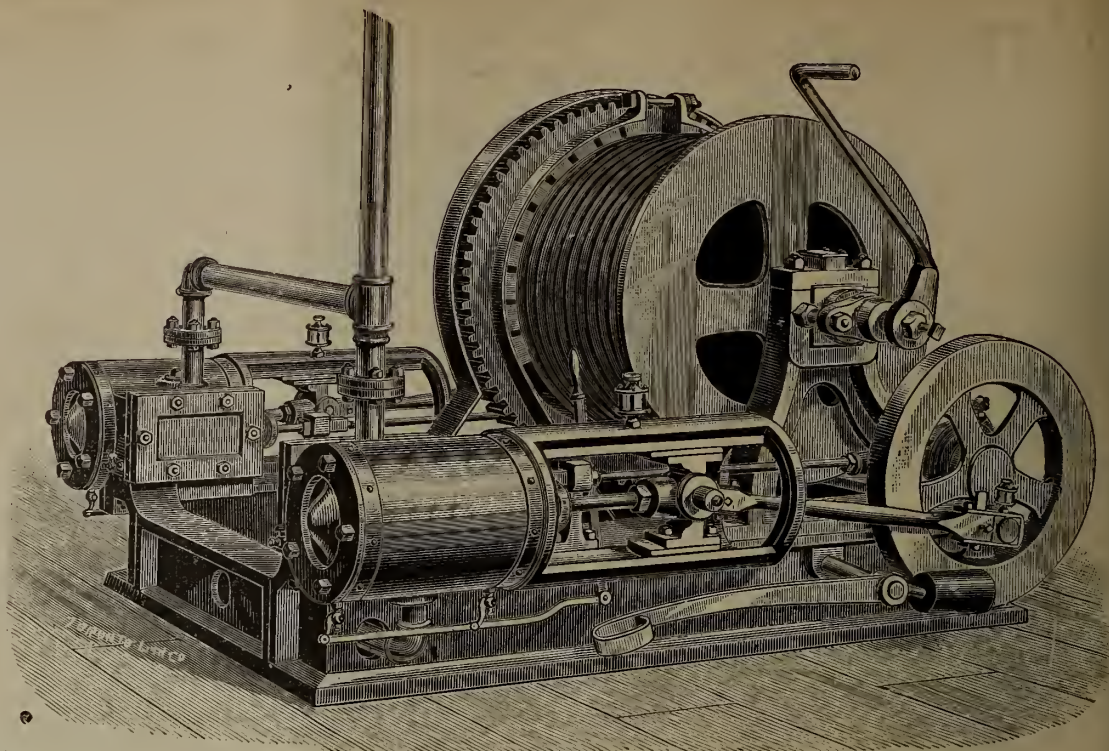
Deputy Minister of the Interior.

JOHN DOTY ENGINE CO.

Toronto, Ont.

MANUFACTURERS OF

Mining & General
Machinery.



HOISTING ENGINES

—: FOR :—

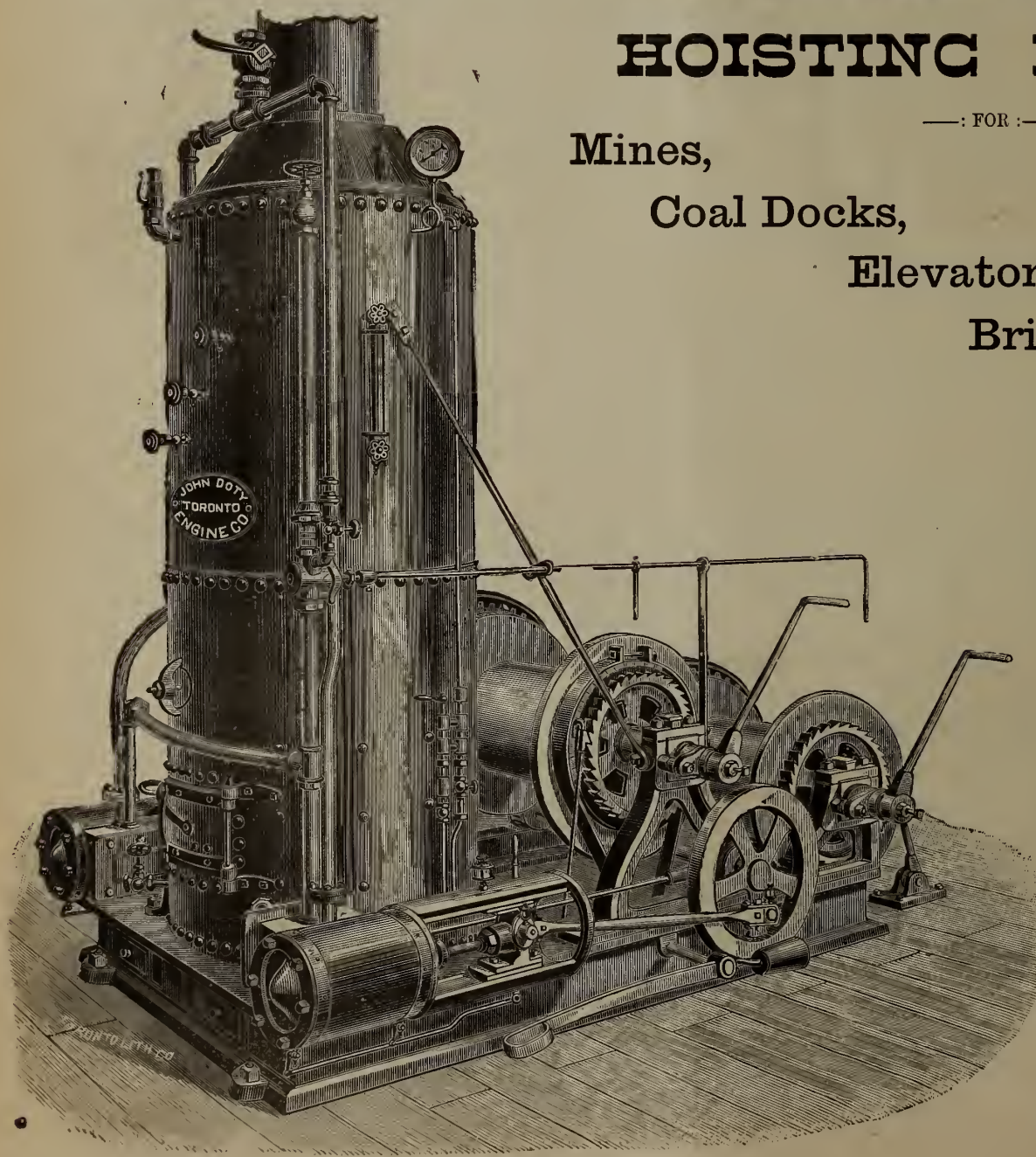
Mines,

Coal Docks,

Elevators,

Bridge Builders,

Contractors, &c.



CORLISS ENGINES

Tug & Steam Yacht Engines,

Mill Engines.

Shafting & Mill
Gearing.

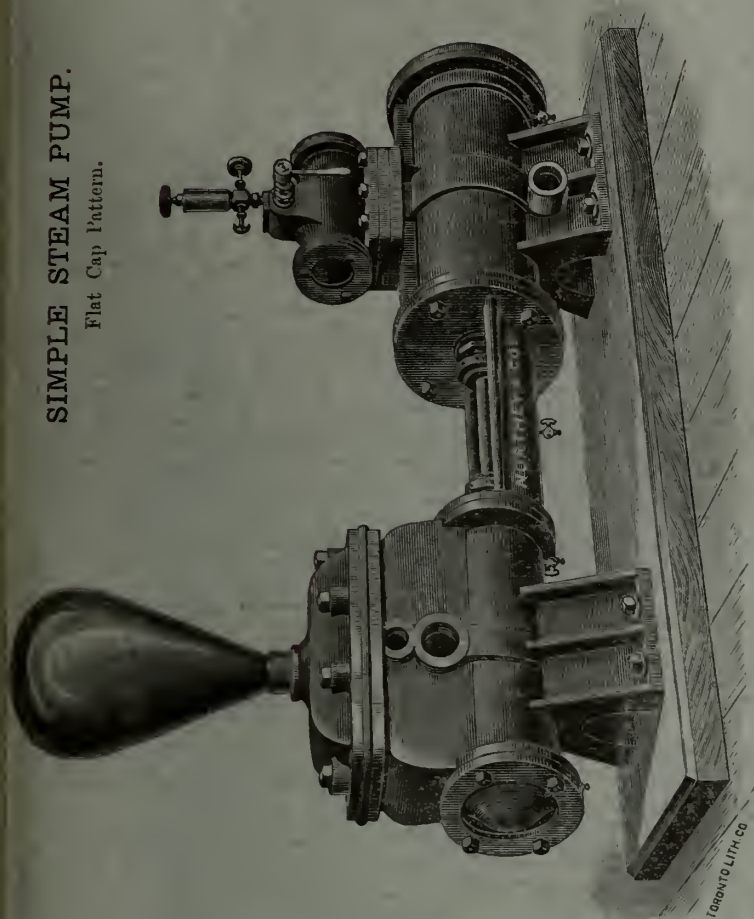
All Descriptions of Boiler
and Tank Work.

Send for Estimates and
Catalogues.

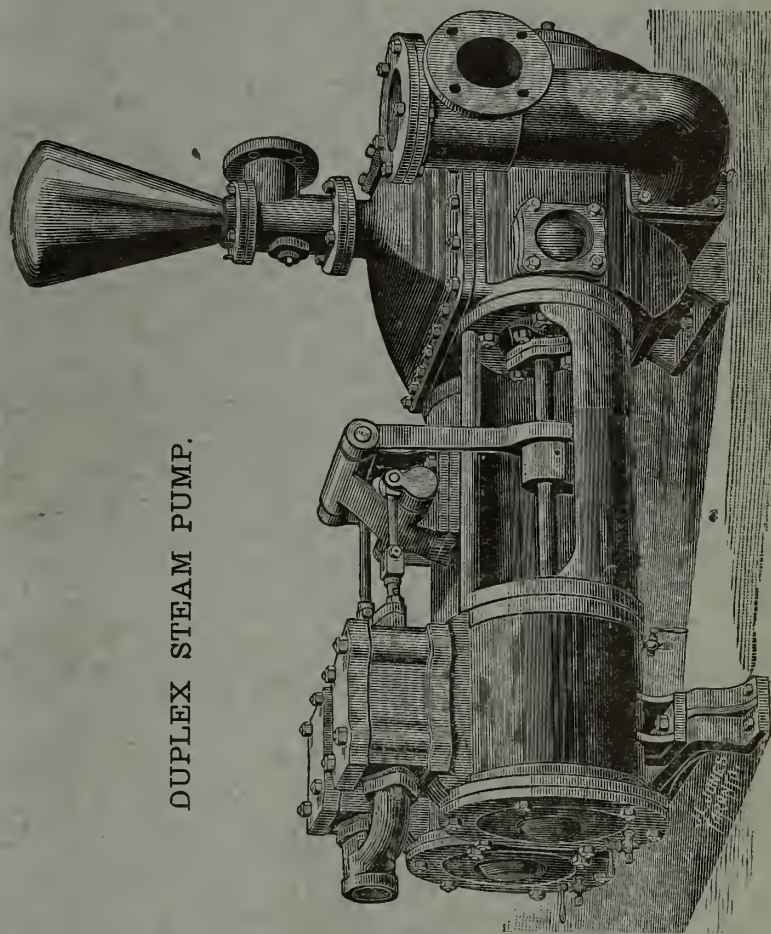
Northey & Co's Steam Pump Works, TORONTO, ONT.

SIMPLE STEAM PUMP.

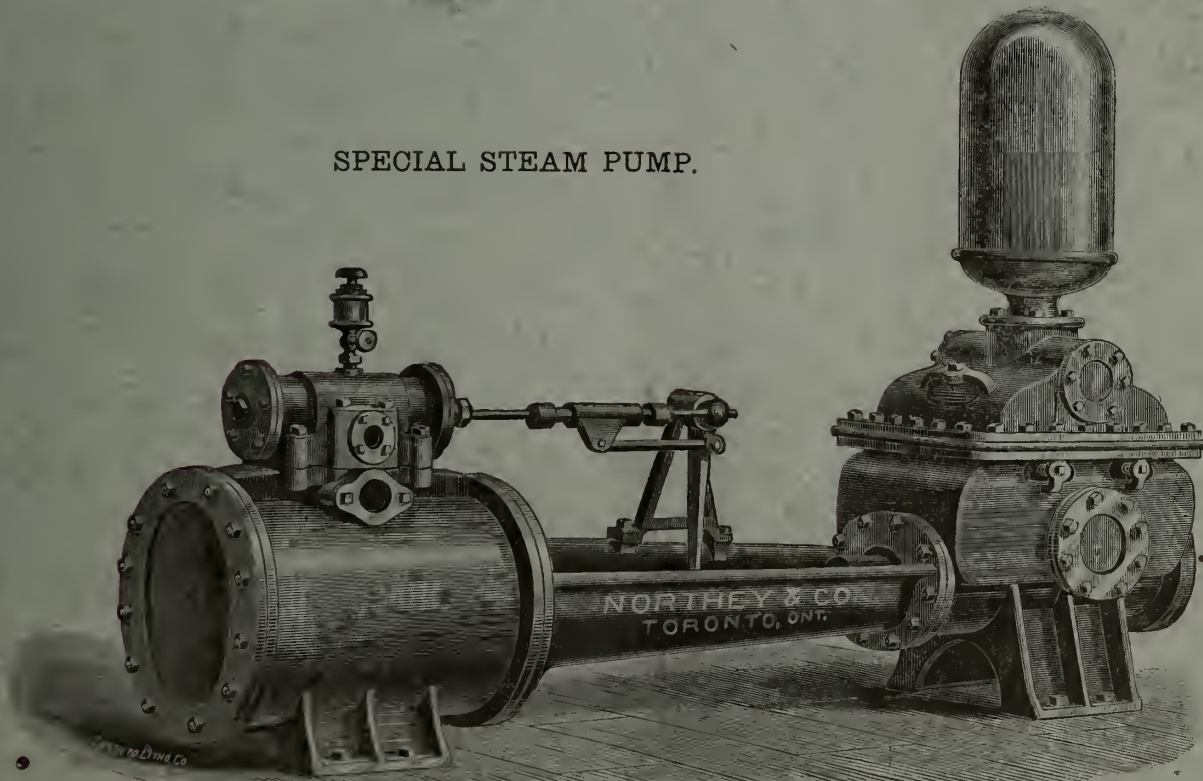
Flat Cap Pattern.



DUPLIX STEAM PUMP.



SPECIAL STEAM PUMP.



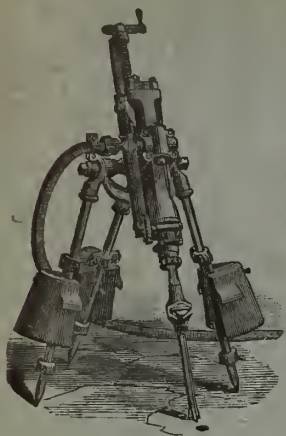
Steam Pumps of the best and latest designs for mining purposes, Boiler Feeding, Fire Protection, and General Water Supply, etc.

NORTHEY & CO.,

Mechanical  Hydraulic Engineers,

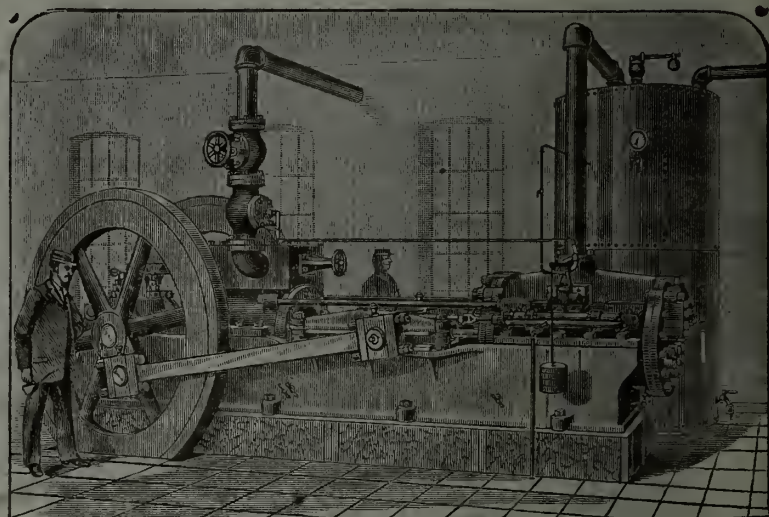
Toronto, Ont.

WORKS—COR. FRONT AND PARLIAMENT STS.

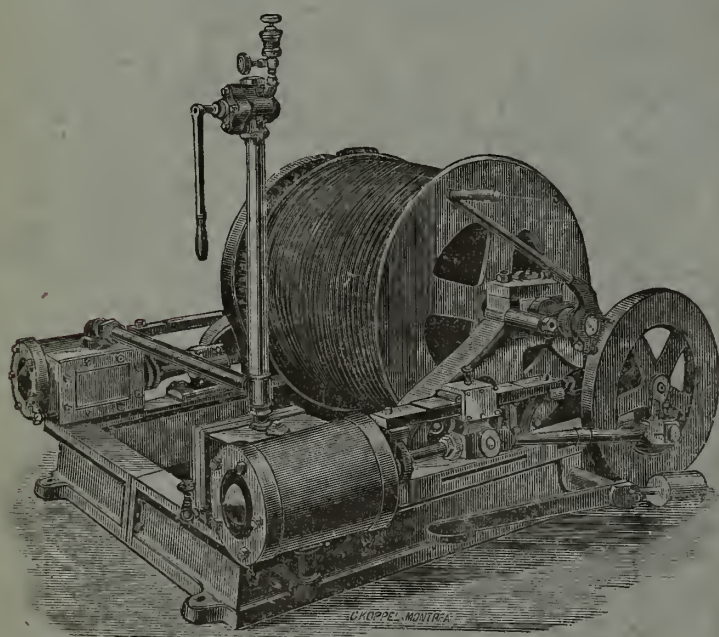


INGERSOLL
ROCK DRILL COMP'Y
OF CANADA
MANUFACTURERS OF

Rock Drills,
Air Compressors,
Steam & Horse Power Hoists,
BOILERS,
GENERAL MINING
Quarrying Machinery
Contractors' Plant.



— ALSO —



Drill Steel, Wire Rope,
Derrick Castings,
Steam & Air Hose & Couplings,
Iron Piping, Fittings,
ALL KINDS OF SUPPLIES
—FOR—
Miners & Contractors' Work.

For Estimates, Catalogues and information address

Ingersoll Rock Drill Co. of Canada

204 St. James St., or P.O. Box 1942, Montreal.

MINING REVIEW

Canadian

Established 1882

Vol VIII.—No. 12.

1889.—OTTAWA, DECEMBER—1889.

Vol. VIII.—No. 12

Rock Drilling and Air Compressing MACHINERY

FOR TUNNELS, QUARRIES, MINES, RAILROADS,

And wherever Rock is to be Drilled and Blasted. Send for new Catalogue of 1889.

RAND DRILL CO., - 23 PARK PLACE, NEW YORK, U.S.A.

Hamilton Powder

COMPANY,

Manufacture Mining, Blasting, Military
and Sporting

Gunpowder,

DYNAMITE, DAULIN, and the new

ECLIPSE MINING POWDER

DOMINION AGENTS FOR

Safety Fuse, Electric Blasting
Apparatus, &c.

OFFICE

103 ST. FRANCOIS XAVIER STREET
MONTREAL.

BRANCH OFFICES & MAGAZINES
at all chief distributing points
in Canada.

MILLER BROS. & MITCHELL

MANUFACTURERS OF

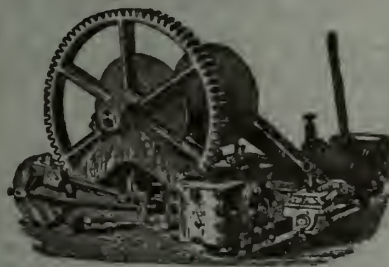
Steam Rock Drills

AND

HOISTING ENGINES,

Mining & Contractors' Plant
&c., &c.

110 TO 120 KING STREET, MONTREAL, QUE.



BLACK DIAMOND
STEEL WORKS.



LAKE SUPERIOR
COPPER MILLS.

PARK, BROTHER & Co. (LIMITED.)

BLACK DIAMOND STEEL,

The best for Mining and General Purposes.
Large and well assorted Stock.

377 St. Paul St., MONTREAL.

LICENSES

—TO—

PROSPECT OR WORK

MINERALS

ON ANY OF THEIR

Lands and Reservations

COVERING NEARLY A

Quarter of a Million Acres

In Eastern Ontario and principally within
the belts containing

Iron, Phosphate, Gold, Galena,
Plumbago, Mica, Marbles,
Building Stone,

And other valuable Minerals, are issued by

The CANADA CO.

For list of lands and terms apply to the
Company's Mining Inspectors,

H. T. STRICKLAND,

Peterborough, Ont.,

For lands in the County of Hastings and
westward, and

ANDREW BELL, P.L.S.,

Almonte, Ont.,

For lands East of the County of Hastings

BACON'S REVERSIBLE AND FRICTION HOISTING ENGINES

For Mines, Inclines or Quarries, and every possible duty. Double or Single Drums.

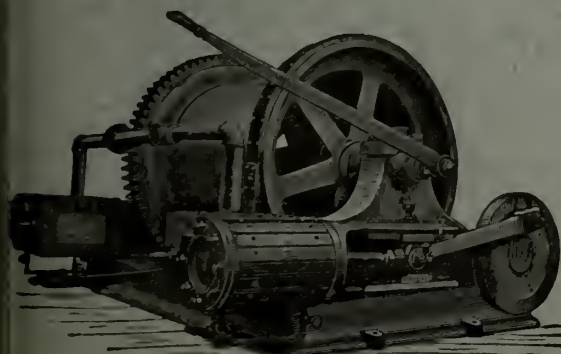
Complete Hoisting and Mining Plants
A SPECIALTY.

COPELAND & BACON,

85 Liberty Street, NEW YORK

JENCKES MACHINE CO.,

Sherbrooke, Que., Manufacturers for the Dominion of Canada.



REFERENCES.—G. H. Nichols & Co., Capelton; Bells Asbestos Co., Thetford Mines; Dominion Bridge Co., Montreal; Dominion Phosphate Co., Montreal.

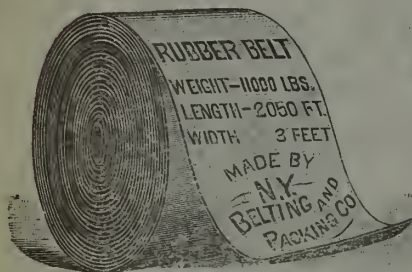
New York Belting & Packing Co.

15 PARK ROW, NEW YORK

JOHN H. CHEEVER, Treasurer.

J. D. CHEEVER, Dep'y Treasurer.

Oldest and largest Manufacturers in the United States of



RUBBER BELTING.

CIRCULAR WOVEN SEAMLESS, ANTI-SEPTIC RUBBER LINED

"CABLE" HOSE and TEST HOSE.

For the use of Steam Engines, Force Pumps, Rolling Mills, Iron Works, Factories, etc. Woven in a superior manner to insure wear, compactness and durability.



"TEST HOSE."



Emery Vulcanite Wheel.

SOLID VULCANITE
EMERY WHEELS

(Large Wheels made on iron centers)

Cuts Cooler and Freer than any other
other wheel in the market.

SALESROOMS:—Chicago, 151 Lake St.; Detroit, 16-24 Woodward Ave.;
Boston, 52 Summer St.; Cleveland, 176 Superior St.
European Branch: Pickhuben, 5, Hamburg (Freihafenarbeit), Germany.

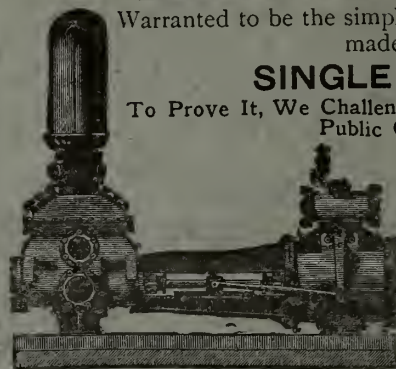
The M. T. DAVIDSON

IMPROVED MINING PUMP.

Warranted to be the simplest and most efficient Steam Pump made, whether it be

SINGLE OR DUPLEX.

To Prove It, We Challenge All Makers of Steam Pumps to a Public Competitive Test.



COMPOUND PUMPING ENGINES,

Obtaining a higher duty than any direct-acting pump made.

MANUFACTURED BY THE

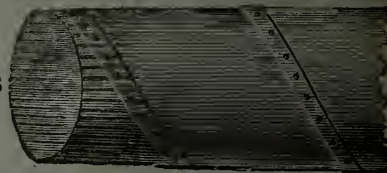
Davidson Steam Pump COMPANY,

New York Office, - - - 77 Liberty Street.

**ROOT'S
SPIRAL RIVETED PIPE**

FOR

Hydraulic Mining,
Water Works
Ranch and Railroad
Water Supplies.



From 2 to 24 inches in diameter and 1 to 25 in length. Manufactured with fittings to suit, capable of withstanding any desired pressure.

ABENDROTH & ROOT MFG. CO.

28 Cliff Street, New York.

Chicago Branch, - - SMITH & KNAPP, 62 South Canal Street

LIDGERWOOD MANUF'G CO.

96 LIBERTY ST, NEW YORK,

34 & 36 WEST MONROE ST. CHICAGO, 197 TO 203 CONGRESS ST. BOSTON,

Largest Manufacturers in the United States of Hoisting Machinery of
Every Description for Mines, Tunnel Work, Contractors,
and General Hoisting Purposes.

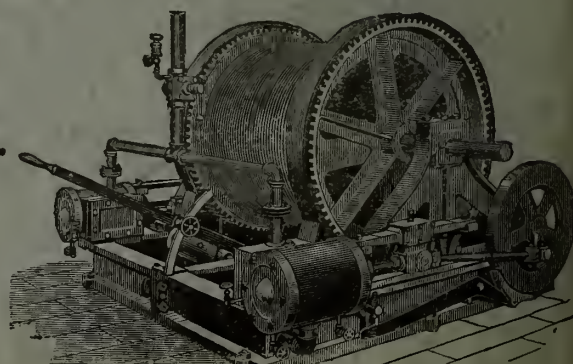
IMPROVED HOISTING ENGINES

FOR MINING PURPOSES A SPECIALTY.

Over 5,000 Engines in Use!

300 Styles
and Sizes.

Send for
CATALOGUE.



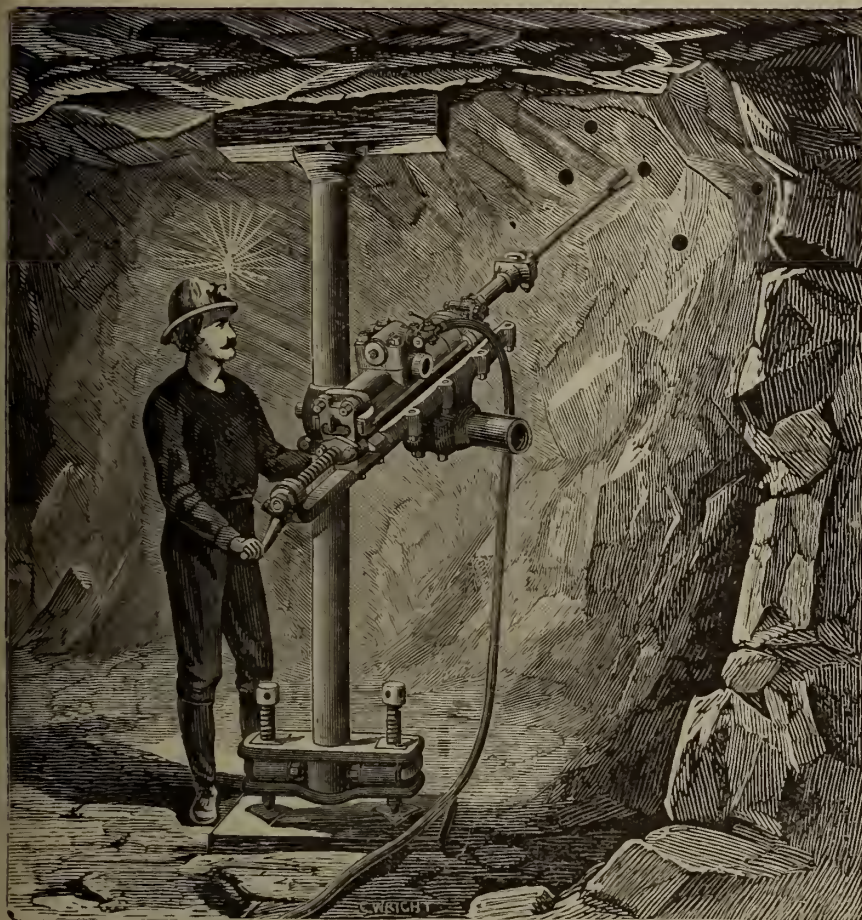
Double Cylinder Reversible Mine Engine.



FRICION DRUM PORTABLE HOISTING ENGINE!

F. G. BECKETT ENGINE CO.

HAMILTON, ONT.



Having had many years practical experience in the manufacture of

MINING MACHINERY

IS NOW PREPARED TO CONTRACT FOR

Stamp Mill Machinery,
Concentration Mills,
Revolving, Roasting and
Drying Furnaces.
Rock Breakers,
Cornish Rolls for crushing,
Amalgamating Pans and Settlers,
Concentrators and
Revolving Screens,
Smelting Furnaces, Retorts,

HOISTING ENGINES,

EITHER GEARED OR DIRECT ACTION.

Cornish Pumping Machinery,
Iron Ore Cars, Safety Cages, &c.,
Rock Drills and Air Compressors.

STEAM ENGINES AND BOILERS.

Marine Engines and Steam Yachts.

Francis D. Taylor

MINING ENGINEER,
BROCKVILLE, - ONTARIO

[SPECIALTY. — The Mining of Iron Ores,
Coals, and the Manufacture of Iron and Steel.

Mr. T. has had for many years the manage-
ment of large mining enterprises in England
and the U. S. A.

CAMERON STEAM PUMP
SIMPLE, RELIABLE, COMPACT, DURABLE.
NO OUTSIDE VALVE GEAR.
THE A.S. CAMERON STEAM PUMP WORKS.
ADAPTED FOR ALL PURPOSES.
FOOT OF EAST 238 STREET, NEW YORK.



DOMINION ASSAY OFFICE AND MINING BUREAU.

Prospecting, Surveying and Examinations by Experts.
Mining properties purchased or floated on the European
markets; Capital found for developing same. Interest
in good mining property secured.

London Office: 21 Richmond St. E. } TORONTO
33 King St., Cheapside. 44 Victoria St.

**TAYLOR McVEITY,
Barrister, Solicitor, &c.,**

Supreme Court and Departmental Agent,
SCOTTISH ONTARIO CHAMBERS, OTTAWA.

WM. HAMILTON MERRITT, F.G.S.

Associate Royal School of Mines, &c.,
Mining Engineer and Metallurgist,
Will report on Mines and Mineral Properties.
ADDRESS:
15 TORONTO ST., TORONTO, ONT.

J. T. DONALD, M.A.,

Analytical Chemist and Assayer,
124 St. JAMES St - MONTREAL.
Analyses and Assays of every description. Manufactur-
ing processes practically tested. Laboratory instruction
in Chemistry, Assaying and Mineralogy. Terms on
application.

**THE DOMINION
Leather Board Co.**

MONTREAL,

—MANUFACTURERS OF—

Leather Board & Stiffeners

ALSO OF

**ASBESTOS MILL BOARD,
STEAM PACKING, and
FRICTION PULLEY BOARD.**

Samples and prices furnished upon ap-
plication.
Please mention this paper.



ONTARIO

Mining Regulations.

The following summary of the principal
provisions of the General Mining Act of
the Province of Ontario is published for
the information of those interested in
mining matters in the Algoma District,
and that part of the Nipissing District
north of the Mattawan River, Lake Nipis-
sing and French River.

Any person or persons may explore for
mines or minerals on any Crown Lands
surveyed or unsurveyed, not marked or
staked out or occupied.

The price of all lands sold as mining
locations or as lots in surveyed townships
is two dollars per acre cash, the pine timber
being reserved to the Crown. Patentees
or those claiming under them may cut and
use such trees as may be necessary for
building, fencing or fuel, or for any other
purpose essential to the working of mines.

Mining locations in unsurveyed territory
shall be rectangular in shape, and the
bearings of the outlines thereof shall be due
north and south, and due east and west
astronomically, and such locations shall be
one of the following dimensions, viz: eighty
chains in length by forty chains in width,
containing 320 acres, or forty chains square,
containing 160 acres, or forty chains in
length by twenty chains in width, con-
taining 80 acres.

All such locations must be surveyed by
a Provincial Land Surveyor, and be con-
nected with some known point or boundary
at the cost of the applicant, who must file
with application surveyor's plan, field notes
and description of location applied for.

In all patents for mining locations a
reservation of five per cent. of the acreage
is made for roads.

Lands patented under the Mining Act
are free from all royalties or duties in re-
spect to any ores or minerals thereon, and
no reservation or exception of any mineral
is made in the patents.

Lands situated south of the Mattawan
River, Lake Nipissing and French River
are sold under the Mining Act at one
dollar per acre cash.

Affidavits showing no adverse occupa-
tion, improvement or claim should ac-
company applications to purchase.

A. S. HARDY,

Commissioner.

Department of Crown Lands, Toronto.

**CANADA ATLANTIC
RAILWAY.**

THE SHORTEST PASSENGER ROUTE
BETWEEN

**Ottawa and Montreal,
AND ALL POINTS EAST & SOUTH.**

The only road in Canada running trains lighted
with electricity and heated by steam from the
engine. Luxurious Buffet Pullman Palace Cars
on all trains between Ottawa and Montreal. Only
line running through Sleeping Cars between

Ottawa, Boston and New York

And all New England and New York points.

Baggage checked to all points and passed by Cus-
toms in transit.

For Tickets, Time Tables and information apply
to nearest agent, or to

S. EBBS, City Passenger Agent,
24 Sparks St., OTTAWA.

GEO. H. PHILLIPS, Gen. Agent,
VALLEYFIELD.

A. E. CAIRNS, General Agent,
136 St. James St., MONTREAL.

Or at 260 Washington St., Boston, and
317 Broadway, New York.

PERCY R. TODD,
General Passenger Agent

E. J. CHAMBERLAN,
General Manager,
General Offices, Ottawa.

TO MINERS AND OTHERS.

Bannerman & Powers,

VULCAN BOILER WORKS,
428 and 340 Wellington St., Ottawa.

MANUFACTURERS OF

IRON AND STEEL BOILERS

OF EVERY DESCRIPTION.

Tanks, Girders, Iron Roof-
ing, Bank Vaults, Smoke
Stacks

—AND ALL KINDS OF—

SHEET IRON WORK.

Repairs Neatly and Promptly Executed

FENWICK & SCLATER,

Manufacturers of Asbestos, Fire Hose, Files and Cotton
Waste, Miners of Asbestos and Soapstone,

ASBESTOS

Cotton, Leather and Rubber Belting,

42, 44 & 46 Foundling Street, Montreal.

H. R. IVES & CO.,

Hardware Manufacturers and Founders,
QUEEN ST., MONTREAL.

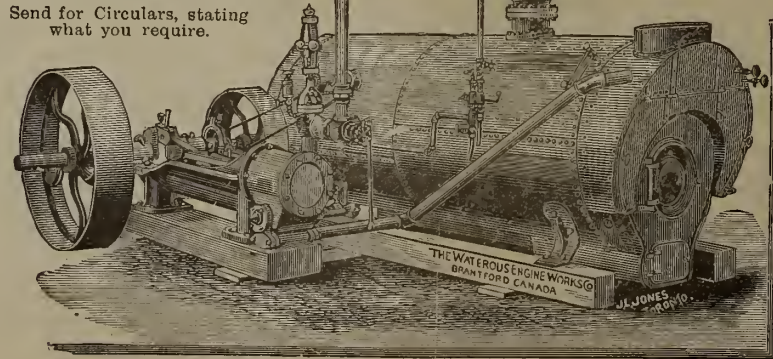
STOVES.	PORTABLE FORGES.	MONTREAL SMELTING CO'S	CASTINGS
TRADE MARK "Buffalo"			Of every description to order.
IRON BEDSTEADS	BLACKSMITH'S DRILLS.	BABBIT METAL.	SOIL PIPE.
FOR MINERS' USE.			

PORTABLE ENGINES AND SAW-MILLS

Of all capacities—from 3000 feet of lumber and up per day.

Saw-Mills. Shingle-Mills. Lath-Mills. Chopping-Mills.
ENGINES OF ALL SIZES. BOILERS of all capacities, IRON OR STEEL, ALL STYLES.

Send for Circulars, stating what you require.



Waterous Engine Works Co. Brantford, Canada.
St. Paul, Minn., U.S.A.

JOHN E. HARDMAN, S.B.
MINING ENGINEER,
OLDHAM, NOVA SCOTIA.

Can be consulted on all matters pertaining to the profession.
 The development and management of Gold Properties a specialty.

WILSON & GREEN,
Commission Merchants,
 PHOSPHATE SHIPPERS.
AGENTS HIGH ROCK MINE.
 30 St. François Xavier St., - MONTREAL.

EDMUND SPARGO,
 Consulting and Mining Engineer, 3 Cable Street,
 Liverpool.
 Owners of or Investors in Metalliferous Mines, Slate, Granite,
 and other Stone Quarries, Brick, Terra Cotta, Fire and other Clays
 and Mineral Estates in general, requiring reliable and sound ad-
 vice either in the Purchase or Disposal thereof, should consult E.S.,
 who has executed important professional Commissions in Germany,
 Austria, Hungary, France, Belgium, Spain, Portugal, Sweden,
 Norway, and in the various Mining Districts throughout Great
 Britain and Ireland. Telegraphic Address: "Spargo," Liverpool.
 Bankers, National Provincial Bank of England, Liverpool.

THOMAS HEYS,
 Analytical and Consulting Chemist and Assayer.
 References are kindly permitted by the following:
 Messrs. Gooderham & Worts, Toronto, Limited; Messrs. P. R.
 Lamb & Co.; John Livingston, Esq., Dominion Bolt Co.
 Assay and Analytical Laboratory
 16 King St. West, opposite the Rossin House, } **TORONTO.**

J. LAINSON WILLS,
 F. C. S., ETC.
 Late Manager Canadian Phosphate Co. (Lim.),
 Reports upon Mines and Mining properties.
 Advice given on Chemical and Metallurgical processes.
SPECIALTIES: PHOSPHATE AND GOLD.
 TELEGRAPHIC OR POSTAL ADDRESS:
WILLS, BUCKINGHAM, P.Q.

Irwin, Hopper & Co.
MINERS AND SHIPPERS OF
MINERALS,
 30 St. François Xavier Street,
MONTREAL, CAN.
 Asbestos, crude and manufactured. Phosphate, Mica,
 Plumbago, Soapstone, &c.

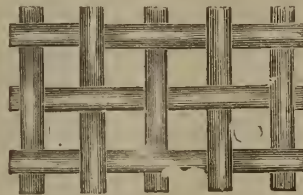
JOHN D. FROSSARD, B.S., M.E.
 MINING ENGINEER & GEOLOGIST,
 30 St. François Xavier St., - - - Montreal.
 Specialty—Phosphate Lands.

JAMES HOPE & CO.,
BOOKSELLERS,
 Stationers, Bookbinders and Printers,
OTTAWA.

MILLAR & CO.
 General Merchants & Shipping Agents
 ATLANTIC CHAMBERS,
 209 COMMISSIONER ST., - MONTREAL
 Cable address, "Hoyer, Montreal." P.O. Box 1095.
 AGENT FOR The Canadian Phosphate Co., Ltd., of London, Eng.,
 The Montreal Union Abattoir Co., of Montreal, Can.
 English Correspondents Messrs. Couper, Millar & Co., Lon-
 don, England.



For Mining Hoisting Derricks, etc.



Strong Wire Cloth and Screens
 For Mining, etc., manufactured by
The B. Greening Wire Co., Ltd.
 HAMILTON, ONT.

Dynamo Electric Machines
AND LAMPS.



ARC and INCANDESCENT
 FOR MINING PURPOSES

ALEX. FLECK, JUN.

Manufacturer of every description of

Mining and Mill Machinery
WATER WHEELS,
STEAM ENGINES, BOILERS, DERRICKS,
STEAM PUMPS, &c.

BRASS AND IRON CASTINGS OF EVERY
DESCRIPTION.

Vulcan Iron Works
 WELLINGTON ST.,
OTTAWA.

W. Blakemore, G.S., M.E., F.
 Member of I. & S.I. | A. Montgomery Evans M.E.
 of Canada & U.S.
BLAKEMORE & EVANS,
MINING & CIVIL ENGINEERS
 Exchange Buildings, Cardiff, S.W.

LONDON OFFICE:
 Robert H. Jones, 82, Queen St., Cheapside, London, E.C.

Reports, Estimates, and Valuations made on Iron and Steel Works
 Blast Furnaces, and all classes of Mining Properties.
CANADIAN BUSINESS PROMPTLY ATTENDED TO.

To Prevent Boiler Explosions
 And other accidents to steam boilers, and to secure
 economy in working, insure with
THE BOILER INSPECTION
AND INSURANCE COMPANY OF CANADA.

Sir Alex. Campbell, K.C.M.G., | John L. Blaikie, Esq.
 President. Vice-Pres.

HEAD OFFICE: - - - - - TORONTO
 G. C. ROBB, Chief Engineer.
 A. FRASER, Sec'y-Treas.

ORFORD COPPER CO.,
COPPER SMELTERS.

Works at Constable's Hook, N.J., opposite new Brigh-
 ton, Staten Island. Copper Ore, Mattes, or Bullion
 purchased. Advances made on consignments for re-
 fining and sale. Specialty made of Silver-Bearing
 Ores and Mattes.

SELL
INGOT AND CAKE COPPER.
 President, **ROBERT M. THOMPSON,**
 Treasurer, **G. A. LAND.**
 Office, 37 to 39 Wall Street, New York.

Robin & Sadler,
 MANUFACTURERS OF
LEATHER BELTING.
 TRY OUR

Waterproof Belting,
 Just the thing for Mining Machinery.
 MONTREAL, TORONTO,
 2518, 2520, 2522 Notre Dame St. 129 Bay Street.

Diamonds, Jewellery, Watches & Silveware
AT ROSENTHAL'S
Goldsmith's Hall, 87 Sparks St.
OTTAWA.

T. D. LEDYARD,
DEALER IN MINERAL LANDS
 4 ONTARIO CHAMBERS, TORONTO.

Will buy undeveloped iron ore and other mineral properties.
 WANTED. — Deposits of Magnetic Iron Ore, Red Hematite,
 Brown Hematite, Galena, Iron and Copper Pyrites, Mica, Soap-
 stone, Marble, Gypsum, Baryta. Samples can be sent by Sample
 Post for 1 cent for 4 oz. or up to 24 oz. in weight.
 Information regarding mines cheerfully given. Corresponden-
 solicited. Crown Land Business attended to

FIRE FELT

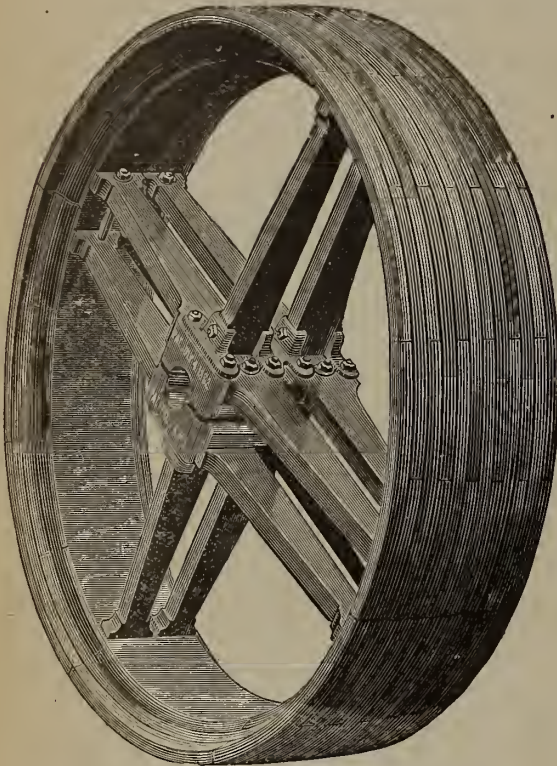
is a new Non-Conducting material, made into sections to fit any size of pipe, and into rolls and sheets for large surfaces. It is a flexible felt-like fabric, made of pure Asbestos. It has been demonstrated by the U. S. Navy and others to be superior to hair felt as a non-conductor, and is indestructible by heat. Covering your Steam or Hot Air Pipes will save from 10 to 40 per cent. in fuel and give dry steam at long distances.

SOLE MANUFACTURERS

The Chalmers-Spence Co.,

Largest Consumers of Asbestos in the World.

419 to 425 E. Eighth Street, NEW YORK.



DODGE PATENT

Wood Separable Split Pulleys

Best Belt Surface, Lightest, Strongest, Best Balanced and Most Convenient Pulley in the World.

WITH OUR PATENT BUSHING SYSTEM

In Comparing Prices of Pulleys please note carefully the following:

1. Our list is lower than most others.
2. Every Pulley is a Split Pulley.
3. Every Pulley is guaranteed to transmit from 25 to 60 per cent. more power than an iron one with same tension of belt.
4. Our Pulleys are 70 per cent. lighter than iron pulleys.
5. The fastening does not mar the shaft.
6. They are perfect in Balance.
7. They can be used on many different sizes of shafting.
8. They are the most thoroughly made wooden pulleys in the world.
9. And the handsomest pulley on the shaft.
10. No chances to take. Every pulley as represented or no sale.

Order a Sample Pulley, after which you will have no other.



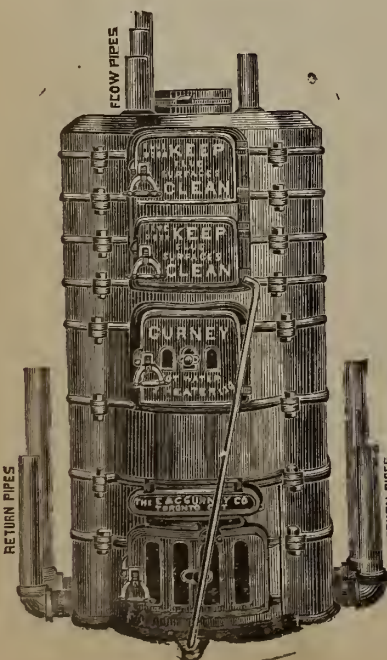
EVERY PULLEY IS A SPLIT PULLEY
Made in any size from 9 inches to 16 ft. diameter with original bores of 3 and 3½ inches, bushings to be used for intermediate sizes; larger ones bored to order.

WE ALSO MANUFACTURE
WOODEN GROOVED PULLEYS FOR THE TRANSMISSION OF POWER
BY MANILLA ROPE,

Under the Dodge Patent System from 5 to 500 h. p. State power to be transmitted, speed of shafts, relative position of shafts, distance between shafts, and we can furnish a clear estimate.

EVERY PULLEY WILL FIT.
22 or more sizes of Shafting.
200 of our Pulleys and an assortment of bushings represent as many as 4,000 iron pulleys, a great advantage to dealers carrying stock.

Apply for particulars to **THE DODGE WOOD SPLIT PULLEY CO., TORONTO.**



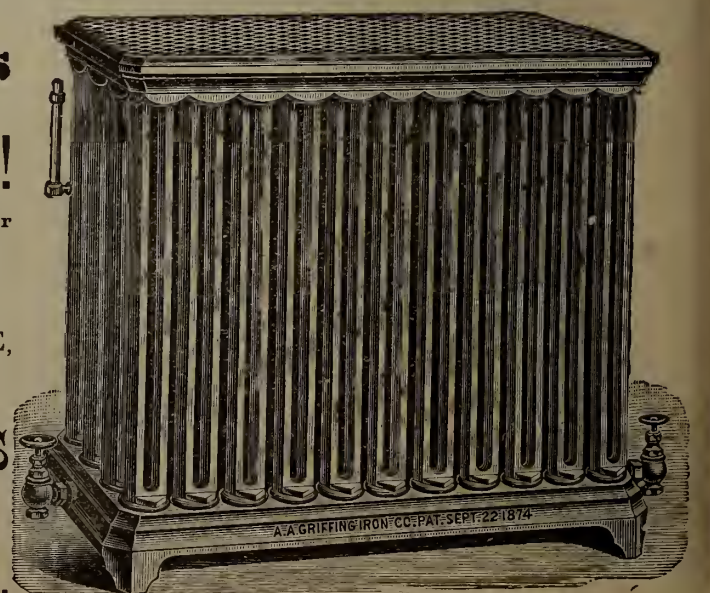
USE GURNEY'S IMPROVED CELEBRATED Hot Water Heaters!

Guaranteed more Economical than any other Heater now made, and containing every known Improvement in Hot Water Heating.

STEAM FITTINGS, CAST IRON PIPE,
REGISTER, GRATES, ETC.

HOT AIR FURNACES
FOR COAL OR WOOD.

E. & C. GURNEY & CO.,
MONTREAL.



Bundy Radiators for Quick Circulation and Economy of Space

MACDONALD & CO., Limited,

—MANUFACTURERS AND DEALERS IN—

**PUMPING MACHINERY, IRON PIPES, FITTINGS, &c.,
FOR MINERS' USE.**

Call or Write us for Prices.

HALIFAX, N.S.

THE NEWARK SMELTING AND REFINING WORKS,

EDWARD BALBACH & SON, Proprietors,
Newark, New Jersey.

**SMELTERS AND REFINERS OF GOLD, SILVER, LEAD,
AND COPPER ORES.**

BULLION AND ARGENTIFEROUS COPPER MATTE received on consignment or purchase.

SMELTING & REFINING WORKS, {
ELECTROLYTIC COPPER WORKS, { **NEWARK, N. J.** |

BUENA FE SAMPLING WORKS,
Agency, Sabinas Coahuila, Mex.

ALFRED SMITH, M.E., ETC. ETC.

IS OPEN TO ACT AS

Consulting Engineer to Gold Mining
Companies.

Examinations and Reports on Mines carefully made out and prepared. The treatment of refractory ores a specialty. Estimates made for the erection of the most approved machinery for treating. First class references in England, Nova Scotia and the U.S.A.

ADDRESS:

ALFRED SMITH, - - - Sheet Harbor, N.S.
Cable Address.—Tapsmith, Sheet Harbor.

Gold Mining Machinery.



I. MATHESON & CO.,

Engineers and Boilermakers,

NEW GLASGOW, N.S.

TRURO FOUNDRY AND MACHINE CO.

TRURO, N.S.

Engineers & Founders

OUR SPECIALTIES

— ARE —

Gold Mining Machinery

Of every kind, with latest Western
Improvements.

ROTARY SAW MILLS

In Latest Styles.

ALSO MANUFACTURERS OF
BOILERS & ENGINES

Iron, Bridges, Stoves,

**SHIP, MILL and GENERAL
CASTINGS.**



G. CLISH,
Manager.

D. McDONALD,
Supt.

S. R. TUPPER,
Sec'y and Treas

WM. STAIRS, SON & MORROW,

174 to 190 Lower Water St., Halifax, N.S.,

Importers and Dealers in all kinds of Mining Supplies, Steel Wire Ropes,

LUBRICATING OILS, EXPLOSIVES, &c. &c.

Correspondence solicited. Goods promptly supplied. Sole agent for Canada for Patent Mineral Fusible Cement.

If you want

BAGS

FOR PACKING

ASBESTOS, PHOSPHATES, ORES, &c.,
Send to us for Samples and Prices.

Every quality and size in stock.

Specially strong sewing for heavy materials.

Lowest prices compatible with good work.

We now supply most of the Mining Companies, and those who have not bought from us would find it to their advantage to do so.

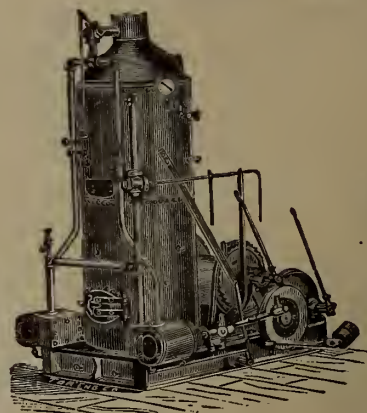
THE CANADA JUTE COMPANY (LTD.)

17, 19 & 21 ST. MARTIN STREET,

Established 1882.

MONTREAL.

M. BEATTY & SONS,
WELLAND ONT.



HOISTING
ENGINES

ENGINES
FOR
Mines
AND
Inclines

Horse-Power Hoisters,

Stone Derrick Irons,

Centrifugal Pumps,



DREDGES,

DERRICKS,

STEAM SHOVELS,

And other Contractors' Plant.

AMALGAMATING MACHINERY.

Stamp Mills for Wet or Dry Crushing. Huntington Centrifugal Quartz Mill. Drying Cylinders. Amalgamating Pans, Settlers, Agitators and Concentrators. Retorts, Bullion and Ingot Moulds, Conveyors, Elevators, Bruckners and Howell's Improved White's Roasting Furnaces, Etc.

CONCENTRATING MACHINERY.

Blake, Dodge and Comet Crushers, Cornish Crushing and Finishing Rolls, Hartz Plunger and Collom Jigs. Frue Vanner & Embrey Concentrators, Evans', Calumet, Collom's and Rittenger's Slime Tables. Trommels, Wire Cloth and Punched Plates. Ore Sample Grinders and Heberle Mills.

FRASER & CHALMERS, MINING * MACHINERY.

Improved Corliss and Slide-Valve Steam Engines,
Boilers--Horizontal, Vertical and Sectional,
IMPROVED STEAM STAMPS.

Holisting Engines, Safety Cages,
Safety Hooks,
Ore Cars, Water and Ore Buckets,
Air Compressors, Rock Drills, Etc.
General Mill and Mining
Supplies, Etc.



Pumping Engines and Cornish
Pumping Machinery,
Improved Water Jacket
Blast Furnaces for Calena and
Copper Ores.
Slag Cars and Pots,
Roots & Baker Pressure Blowers,
Suspended Tramways.

Sectional Machinery for Mule-Back Transportation.

General Offices and Works: FULTON & UNION STS., CHICAGO, ILL.

BRANCH OFFICES: NEW YORK, Room 43, No. 2 Wall St. DENVER, COLO., 1316 Eighteenth St. SALT LAKE CITY, UTAH, 7 West Second South St. LONDON, ENGLAND, 23 Bucklersbury, E. C. CHIHUAHUA CITY, MEXICO, No. 11 Calle de Juarez. LIMA, PERU, South America. JOHANNESBURG, TRANSVAAL, South Africa.

Sole Western Agents for TYLER WIRE WORKS Double Crimped Mining Cloths.

The Canadian Mining Review

CONDUCTED BY . . . B. T. A. BELL

OFFICES:

UNION CHAMBERS, 14 Metcalfe St.
OTTAWA.

Vol. VIII. DECEMBER, 1889. No. 12.

The Phosphate Season of 1889.

The year 1889 will be a memorable one in the annals of the Canadian phosphate industry as having witnessed the first considerable awakening of foreign interest on its behalf. In December, 1888, Mr. Hermann Voss read a paper, in London, before the Chemical Manure Manufacturers' Association, entitled "Our Supply of Phosphates." This aroused considerable interest in the subject, and in January articles appeared in the *Times* and the *Morning Post* calling attention to the importance of the Canadian apatite deposits. The *Times* said: "In view of the scarcity of and increasing demand for phosphates, it may be well to point out that in our nearest large colony we have a source of supply which ought to be worked by British capital for the benefit of British agriculture." Nitrate had acquired great notoriety both as a fertilizer and as a means of making money, but an eminent authority made the statement that the nitrate used alone as a fertilizer was too stimulating and ephemeral in its effect, and it needed to be combined with phosphate in the ratio of two or three parts of phosphate to one of nitrate. The article in the *Times*, comparing the two, used these words: "To adopt a homely simile, the nitrate is like a glass of spirits, while the phosphate may be compared to a plate of beef." This struck the British imagination and phosphate was soon "the talk of the town." The agricultural papers, as well as the daily press, repeated the illustration until it became widely known. Col. North's nitrate mines and associated schemes had created such great fortunes that nitrate had become a household word, but now it became the fashion for every "city man" to say: "Nitrate is very well as a fertilizer in its place, but after all it is only a glass of spirits whereas phosphate is as a plate of beef." Financial men now began to say: "If money can be made in nitrate, why not in phosphate, which is required by the soil in threefold quantities?" Cables began to pour into Canada asking for offers of lands, and in a little while a good portion of the phosphate district was for sale on the London market. Some of our leading mine owners and several business men went to the scene of the excitement. Even eminent statesmen started for England with bonds of lands in their trunks, though the reporters were told to announce in the newspapers that the visit was "purely a pleasure trip." Prospectuses were soon drawn up offering Canadian lands to the public at from two to five times the price asked by the holders, which was generally quite the full value to begin with. The *Star*, the Radical evening daily, attacked these

schemes, exposing the inflation; and the issues fell flat. One scheme that asked for £150,000 only got £7,500 subscribed, and it was found that the British public were not enthused about phosphate investments. The summer holidays came and the boom collapsed, to the sorrow of many land owners, who had repeatedly been told by letter or cable: "The thing is done;" "The scheme is placed;" "Your lands are sold;" "The company is fully underwritten;" "It is certain to go." But out of hundreds of thousands of ones that were offered not one was sold, except that one private enterprise, the Foxton mine, which was taken up with Canadian and English capital on a comparatively snug basis. But the talk and excitement had made people acquainted with phosphate and with the Canadian deposits. In the fall, several visitors came across to make return "pleasure trips," and finding local prices so much lower than those of the London company promoters, they in a few cases bought lands, and in others bonded properties, intending to try the public again with them at more tempting prices. Several schemes are now in hand of this nature, and another trial of the sentiments of the investing public will soon be made. All these efforts have merely been for the purpose of speculating in lands, but it is pleasant to notice that now some enterprises are being undertaken that are based on genuine intentions to make a profit out of mining. The success of some of the properties that have been worked this year has demonstrated that "there is money in it," and we confidently predict that a great impetus is to be given to Canadian phosphate mining. It is well that the inflated schemes have failed, as they could only have led to disappointment, the capital being, in most cases, entirely out of proportion to any possible profits; but lands taken up on a legitimate basis and a large working capital being applied to the mining, instead of to the coffers of promoters, will doubtless produce results that will secure a permanent prosperity to the industry and a vast increase in phosphate production.

In our last issue we estimated the year's output of phosphate as being 32,466 tons, the largest annual production yet reached. Since then additional returns have been received, which increase the total yield to a little over 33,000 tons. Compared with the yield of other countries this is a small figure, as South Carolina alone produces over half a million tons yearly. But the Canadian industry has only just fairly got on its feet. Years of effort and much money have been spent in learning how to mine it profitably. The deposits are confessedly irregular and uncertain in occurrence, and those who have worked in a small way on single seams for a limited time, as has been usually the case, have not often been rewarded. It has been learned that large operations are essential to success; that it pays to break ground extensively, thus discovering many "bunches" that would have

been passed by if a single vein had been narrowly followed; that the true economic method of mining is to work a large number of pits simultaneously, for when one is "pinching" another will be "coming in," and the average output will be maintained. We hope soon to see a large amount of capital put into the working of these mines.

A few features of the season's business call for remark. Prices have steadily advanced and the prospect is favourable for still higher figures. The old standard of 1s. 3d. for 70 per cent. is still a long way out of sight, but there are those who predict that it will be again attained in the near future. The price has been as low as 7½d, but it got up this year to 10d. and a higher rate is now asked. Carolina phosphate of 55 per cent. quality has in the past commanded the same price as Canadian 70 per cent. This has been owing partly to difficulties arising from lack of knowledge how to treat the newer article and partly from the weakness and lack of accord of Canadian sellers. Time and experience will doubtless remedy these defects.

The export to the United States of 4,176 tons is a very encouraging feature, especially as it consisted of low grade phosphate that was formerly thrown away. Some progress is being made in the use of this on the soil in the crude state, without a mixture with acid, and this promises to create a large demand. It is also a very favourable feature that the English market is now calling for these low grades, and whereas two or three years ago it was difficult to sell anything below 80 per cent. in quality, there has this year been a good demand for 60 per cent. phosphate. This greatly helps our mines, as what is obtained from this grade is nearly all clear gain, it having to be mined in any event with the higher class rock.

Freights were fairly plentiful early in the season, and much room could have been had all midsummer for low figures, but the low water in the Lievres River prevented shipments to Montreal in time to avail fully of the opportunities. The too long deferred completion of the locks at Little Rapids is now eagerly looked for in another year. In the fall, cargo rates being high and vessels scarce, rates for phosphates rose to a prohibitory figure. About 1,200 tons had to be carried over the winter at Montreal, and 3,000 or 4,000 tons more at the mines, besides large quantities of second quality phosphate that awaits grinding by the mills. 7s. per ton was the prevailing rate, though as low as 5s and as high as 12s. was paid.

The railways projected or building in Ontario and Quebec will prove of great assistance for the transport of phosphate. The railroad will be completed next season from Westport across Bob's Lake giving access from that district to the Grand Trunk Railway at Brockville and the Canadian Pacific Railway at Sharbot Lake. The Kingston and Smith's Falls road will also benefit a

large tract of phosphate country. The Ottawa and Gatineau Valley Railway, now in course of construction, has been graded as far as the Pêche, and when finished will open up a very extensive belt of phosphate and other mining lands, now undeveloped, mainly owing to scarcity of transportation.

With the continued working of the present mines and new enterprises now starting and the good commercial outlook, it seems safe to predict that Canada's best phosphate year will be surpassed by a better one in 1890.

The Duty on Mining Machinery.

We notice that the *Globe* and other papers have been publishing a statement announcing that the Dominion Government had at last decided to remove the duty on imports of mining machinery. The statement is premature, as the following letter from the Hon. M. Bowell shows:—"I have your favor of 9th inst., and cannot understand how the "*Globe*" obtained the information which it purports to give respecting the duty on mining machinery, as the Government has come to no decision in the matter. Even if it had, an intimation of that kind, as you are aware, would not be given until it had been laid before Parliament."

Canadian Iron Ore and New England Furnaces.

Our attention has been drawn to the following letter by a Mr. A. Evans, Jr., which appears in the *Bulletin* of the American Iron and Steel Association:

"I spent nearly three months of the summer of 1888 in the provinces of New Brunswick and Nova Scotia, and was part of that time in charge of the blast furnaces of the Londonderry Iron Company, at Acadia Mines, Nova Scotia. I did not find a single furnace in blast in either of these provinces, except one of the two stacks of the Londonderry Iron Company, and this furnace the company was only enabled to run on account of having a demand for the larger part of the iron at its own works, which consist of a pipe foundry, a rolling mill and an axle forge. As the Londonderry Iron Company could not successfully compete in the open market with imported pig iron, even with the \$4 protection, and \$1.50 of bounty at that time allowed by the Canadian Government, it built its pipe foundry under an especial concession, the government giving the company, if my memory serves me correctly, \$12 per ton on pipe, as an inducement to start a foundry of that kind in Nova Scotia.

Another reason for the company not running its idle stack, even if its own necessities required the pig iron, was that it was hard pushed to procure enough iron ore for the furnace then running, although Mr. John Sutcliffe, the general manager of the company, had travelled all over the province endeavoring to secure an additional supply. Indeed, while I was there, Mr. Sutcliffe took a two weeks' trip to Newfoundland in search of a supply of iron ore from that country, but failed to secure it. The ore the company was using would not have been used by any furnace in this country, as you will see from the analyses given below, which were taken from a lot of ore of better quality than the average output of the mines. The following analysis of a specimen of calcareous limonite ore, taken from the Totten mine, at Londonderry, will give a very fair idea of the richness of the ores the company was using:

	Per cent.
Insoluble matter	5.48
Ferric oxide	54.88
Ferrous oxide	2.39
Alumina	2.81
Manganese	1.36
Lime	22.80
Magnesia	4.40
Average metallic iron	31.00

An analysis of a specimen of limonite ore, called hematite, taken from the West mine, gave the following results:

	Per cent.
Silica	16.00
Alumina	0.86
Magnesia	0.46
Phosphoric acid	0.57
Metallic iron	40.00

The coal received for the manufacture of coke was very poor, and all of it contained a great deal of slate, although the miners declared that they had taken especial care in its preparation and loading. The analyses given below were made from coke manufactured from the best coal received, we rejecting as high as twenty car loads in a single month as totally unfit for coking purposes. The coke made from coal taken from the west slope of the Spring Hill Company analyzed as follows:

	Per cent.
Ash	19.48
Sulphur	1.01

A sample of coke made from coal from the Albion mines analyzed as follows:

	Per cent.
Ash	18.38
Sulphur	0.87

This showing would undoubtedly condemn any property producing such coal and coke in any part of the United States.

Before returning to the States, I visited the output of the iron ore mine at Digby Bay, a deposit represented to be the largest and best in the province, and found it entirely unsatisfactory. I could see no indications of the existence of a large quantity of ore, and the specimen I brought away (a carefully selected sample) contained less than 40 per cent. of metallic iron, and was very high in silica, I think 21 per cent. It will be much cheaper for the New England furnace-men to use American iron ores, which are higher in metallic iron and lower in objectionable acids, or even to import Spanish, Cuban or Elban ores, paying the duty of 75 cents per ton, than to attempt to use any of the iron ores mined in the eastern Canadian provinces. And this applies to fuel also, for they will find that one ton of Pennsylvania coke, or $1\frac{1}{4}$ tons of anthracite coal, is worth two tons of any coke they can procure from the Canadian provinces."

It is very apparent that the author of this remarkable letter has been inspired by a desire for political effect rather than for a fondness for speaking the truth. It would be easy to find in many parts of the world a tract of country as large as New Brunswick not adapted for the manufacture of iron, and the fact that this article is not produced there can hardly be called an argument against any proposal to take the duty off Canadian iron ore. The question of costs, of tariff protection, and special bonuses, may be passed over here, as reference is now intended more particularly to the supply of ore. The analysis given of calcareous limonite ore is certainly a curiosity, as it is the first time the public have heard of an iron ore containing free lime. The Londonderry ore has never laid any claim to be of high grade, the average metallic per cent. of the furnace supply varying from 40 to 45. The coke is silicious, running about 5 per cent. over the average Connellsville, but apart from this it is of excellent quality, and better cokes could be secured. Small supplies of excellent ore have been drawn from Picton and Brookfield, and enough Bessemer ore to run both furnaces could have been procured from Picton county, but for the fact that the owners of the deposits have seen their way to do better than sell or lease to the Londonderry people. At present a railway is in course of construction from the Picton coal field to the iron ores of that county, and preparations are being made for building furnaces, etc. There

are also in Guysboro county, and in several parts of Cape Breton ample supplies of first class ore.

The writer speaks of visiting "the output of the iron ore mines at Digby Bay, a deposit represented to be the largest and best in the province." As a matter of fact a small quantity of charcoal iron was made here a number of years ago, but, without any prejudice to the present or future values of these deposits, they have never been publicly represented as the "largest and best." As another matter of fact it is known that at numerous points in Digby and Annapolis counties there are iron ores practically pure and running from 60 to 65 per cent. of iron. The general tenor of the letter would imply that the writer after a very short stay in Nova Scotia, has desired to mendaciously condemn the iron ores of the province in general, and the Londonderry works in particular, and to conceal this motive under a specious cloak of political patriotism. He apparently forgets that if the United States takes the duty off iron ore, the Nova Scotian ore would have to compete with those from Cuba, Algiers, etc., and that curiously enough he is arguing against the best interests of those he pretends to be putting on their guard.

The attitude of the iron ore owners in the Maritime Provinces is one of indifference as to the adoption by the United States of the policy of removing the duty on iron ore. If they do not see their way now to ship their rich ores to the States in competition with other foreign ores, they would be on exactly the same footing if the duty were remitted, the only difference being a gain to the United States furnace man who is now handicapped by the native ores being regulated in price to compete with the foreign ore paying a duty.

The Promotion of Joint-Stock Companies.

Advices from England indicate that the promotion of public companies to operate industrial and mining enterprises has experienced a check owing to the losses sustained by the associations whose business it is to underwrite working capital, and the expenses of floating such companies. The stock of several recent enterprises has not been absorbed or taken up by investors to the extent expected, in some cases only from 5 to 10 per cent being subscribed, leaving a large amount of cash to be provided by the underwriters who are practically guarantees for the public to the vendors. As everyone knows, the floating of a company is attended with a great deal of expense, frequently as high as £4,000 Sterling being incurred. It can readily be understood, that a few losses to that amount, besides the difficulty and trouble of working off the stock, must render underwriters rather chary of assuming new obligations, for a time at least. The recent increase in the rate of discount by the bank of England and the larger

rate of interest now obtainable for money has also had a cooling effect, and a large amount of cash lately available for speculative enterprises has thus been withdrawn from circulation. With the opening of the new year, and the distribution of dividends, some improvement however, may safely be anticipated.

The Phosphate Trust (Limited.)

Just as we go to press, an occasional correspondent has handed us a most remarkable document which purports to be the Prospectus of a new concern on the eve of being submitted to the English public under the pretentious title of "The Phosphate Trust (Limited.)" The authorised share capital of this prodigious scheme is placed at £1,000,000 sterling, divided into 99,500 ordinary shares of £10 each, and 500 Founders' shares of £10 each. The acreage proposed to be acquired consists of 38,556 acres as follows:

ONTARIO.	
County of Lanark	5,237 acres.
" Renfrew	450 "
" Frontenac	9,695 "
	15,482 "
QUEBEC.	
Township of Templeton	4,698
Gore of Templeton	3,210
Township Portland East	2,583
" " West	1,317
" Wakefield	2,400
" Hull	730
" Derry	200
" Buckingham	2,446
" Bowman	4,496
	23,074

We know nothing about the economic value of this extensive area of so called phosphate lands, and the highly colored prospectus (on green tinted paper) fails to enlighten our ignorance, further than to quote brief excerpts from the reports of the following illustrious mining experts: *H. Loken, C. Davenny, Peter Powers, Thos Dowsley, J. F. McAndrew and E. Newton*, men, we need not say, wholly unknown to us or to the profession as mining engineers, or with any reputation as such. In addition to these celebrities, there are published portions from reports on other lots, written by the owners themselves, and these, very naturally, are most flattering and highly eulogistic. In such an extensive area, within the phosphate belt, there should be properties which, if systematically worked and judiciously capitalized, would amply repay investment, and that such may exist in the proposition before us, is suggested by quotations from the reports of Dr. Sterry Hunt, Prof. B. J. Harrington, Mr. Lanson-Wills, Mr. John D. Frossard, and a few others eminent in the profession, but these, we surmise, do not cover one-third of the mining lands to be submitted to the public. In conclusion, we cannot help thinking that the promoters will require something more than an indiscriminate collection of reports, something more specific and definite as to the ways and means by which such an enterprise is to be made to pay, before their scheme can be thought worthy of consideration by thoughtful

men and the investing public. For the credit of the Canadian phosphate trade, we trust the proposal, as it at present exists, will not be put to the public.

LETTERS TO THE EDITOR.

Halifax, Dec. 10th, 1889.

The Editor

THE CANADIAN MINING REVIEW:

SIR,—Under the head of Rockingham in your last issue you report the late discovery of gold near Princes Lodge, Nova Scotia, and state "but a close examination of the lodes as yet stripped fails to discover any gold in them." This statement is deliberately false, as the leads show gold, and we are prepared to show the same to anyone who may come to us and ask an examination. . . . There is no intention of putting a mill on the property until the work of development has been sufficiently advanced to warrant the same. The prospects so far are most encouraging.

Yours, &c.,

HENRY ARCHIBALD,
W. J. MORRISON,
W. G. COOMBS.

[The statement published in our last issue came from a thoroughly reliable source. However, our correspondent may have been misinformed, and we insert the above with pleasure.—EDIT.]

Stormy Meeting of the British Columbia Smelting Company.

A meeting of the shareholders of the British Columbia Smelting Company, limited, was held on Thursday, 21st ult., at Winchester House, Old Broad Street, London, Mr. W. J. Steele presiding.

The Chairman said that that was an adjournment of the meeting held on September 2nd. The shareholders had expressed a very natural wish that the report of Mr. Juddins should be printed and circulated. That had been done, and the accounts in London had been made up to September 30th, and had been audited by Messrs. Turquand, Youngs & Co., and had been found correct. Appended to the London accounts was a statement of receipts and expenditure at Vancouver. That statement had been signed by the local directors and the secretary, but was not audited; and, on submitting it to Messrs. Turquand, Youngs & Co., they most properly, in his opinion, refused to deal with it. In fact, the accounts were in such a shape that they could not possibly be audited. The board immediately wrote to the local secretary, instructing him to have those accounts audited on the spot. As soon as these, properly audited, were received from Vancouver, they would be incorporated with the London accounts, and a balance-sheet would be drawn up and audited by Messrs. Turquand, Youngs & Company, and issued to the proprietors. The sum due to the Bank of British Columbia was as nearly as possible £7,600, which was carrying five per cent. interest, and the board had received a telegram during the last few days to the effect that, if the interest to the 31st inst. was not paid, proceedings would be commenced under the mortgage. He considered that the bank had treated the company with great indulgence in this matter, as the notice of foreclosure expired on September 10th, and since that date they had taken no action against the company under the mortgage. They could not, however, expect them to wait an indefinite time for their money, even if they had ample security. There was a suggestion made at the last meeting that about £2,000 would be sufficient for the purposes of the company; but the directors were advised that any attempt to spend a couple of thousand pounds on the works would be so much money thrown away, and they could not recommend any such course. The board strongly recommended the shareholders to immediately subscribe a sufficient amount to pay off the mortgage to the Bank of British Columbia, so that the property might be kept intact until arrangements could be made for carrying on

active operations next spring. The directors recommended that the advances made by the shareholders for this purpose should be secured by debentures, and that the existing mortgage in favor of the bank should be transferred to a trustee for the debenture-holders. That would secure the redemption of the advances. The local directors had sent a very long statement to the board to complain of the remarks made at the last meeting, and resigning their seats. While the directors regretted that they would lose the services of gentlemen holding responsible positions in Vancouver, they could not withdraw from the position that they had taken up—that the company owed its present position to bad management at Vancouver, and improper management at the mine. The Chairman then read a long letter that had been received from the local committee at the mine, setting forth the position of affairs there. As early as December last the board had a very strong suspicion with regard to the state of affairs at the mine, and on January 14th a telegram was sent to the local directors telling them if they could not proceed with the smelting to shut down the works. That telegram was disregarded. Had they paid attention to it the company would have been saved a very considerable expense. He concluded by remarking that what was before them was the question, how to raise money to pay the Bank of British Columbia.

Mr. Oscar Reumen (interrupting): I wish to know, sir, why a letter, dated July last, numbered 54, was not produced when you had it in your hands at the last meeting? I want to ask you that question straight and point blank. There was a letter in your possession, and that letter was not produced at the last meeting.

Mr. James (a director): I don't quite understand, sir, the nature of your remark. What letter is it you refer to? and may I ask how you come to know of the number of the letters sent to us?

A Shareholder: Let the chairman answer.

Mr. James: Sir, I don't stand here to be dictated to.

Mr. Reumen: Mr. Chairman, there is a simple question about a letter; cannot we have an answer? ("Hear, hear.") This letter was in your hands, and you must have known of it at the last meeting. I want to know all about it. ("Answer, answer, answer.")

Mr. James: You ask a question which I am not prepared for the moment—"Answer, answer."—I will ask the secretary. ("Sit down; let the chairman answer.") If any gentleman here professes to recollect any letter, I confess that I have not that capability. (Uproar and cries of "Sit down.") I go further and say this—(Uproar, and "Answer the question.")

Mr. Reumen: Mr. Chairman, I have asked a question and I insist upon an answer. I do not want any outsiders to answer me. ("Hear, hear.")

Mr. James: I am not an outsider. (Laughter.)

Mr. Reumen: I am addressing the chairman, and I want to be answered by the chairman. ("Hear, hear," and noise.)

The Chairman: I will give you an answer. ("You?")

The Chairman: The question of producing that letter was not considered. ("Oh, oh.") There was no discussion by the Board in any way, and that Board had no object, directly or indirectly, in not referring to that letter at our last meeting; and if that letter had been asked for at the last meeting, it would instantly have been produced. We have no object in keeping back that letter. I can only say, however, that the letter is in direct disagreement with the letter of February, 28.

Mr. Reumen: I say that the last meeting was adjourned for the purpose of introducing that letter, and it would not have been adjourned if that letter had been produced. ("Hear, hear.")

The Chairman: I think you are making a mistake. ("No, no. There was no mistake.") The meeting was not adjourned for the purpose of producing that letter.

Mr. Birkin: I wish the chairman to read my letter to him tendering my resignation as director.

The chairman read the letter, which stated that Mr. Birkin resigned his position on the Board in consequence of language used at the last meeting, imputing to the Board "scandalous, disgraceful and sinister motives." That language was reproduced in the *Financial News* and the *Financial Times* of the following day.

Mr. Birkin then stated that he had done a great deal for the company and spent a lot of time in its promotion. They were in difficulties and he wrote a cheque for £500, and subsequently for £250, in order to help them out of those difficulties. He had every confidence in the Board and did not feel inclined to give his valuable time as a director when that gentleman stood up and accused them of being influenced by "scandalous, disgraceful and sinister motives." He was a larger subscriber than most men here, and he thought it was certainly discreditable that gentlemen made such remarks without foundation. ("Hear, hear.") He ought to have had some knowledge to justify an assertion of that kind. ("Hear, hear.")

Dr. Jones said that, as he was accused of having made those remarks, he was entitled to reply. His reply was that at the last meeting the chairman stated that unless they subscribed sufficient money amongst them within six or seven days their property would be lost. He (the

speaker) got up and asked when that information was received. The chairman replied that they had received it a month before.

Mr. Reumen : Six weeks.

Dr. Jones : Six weeks or a month ! And, although they received that important information, they did not convene a meeting, and they only gave it to the shareholders when the meeting was convened. They never informed them that the mortgagees intended foreclosing. He (the speaker) took into consideration that if they had that notice fully six weeks beforehand, they ought to have called a meeting of the shareholders together, or, at any rate, some of the larger shareholders, and give that information, so that they might have had time to protect their interests and their property. ("Hear, hear.") He appealed to the shareholders present whether, under the circumstances, he was not entitled to make that remark. ("Yes, undoubtedly.") There was one thing he wished to say with regard to Mr. Birkin; he felt extremely sorry that that gentleman had resigned his position on the Board. He looked upon Mr. Birkin as the only member of the board who had their confidence—"Hear, hear"—and he felt that now that Mr. Birkin had resigned their case was hopeless, unless they had a complete change in the directors. ("Hear, hear.") With regard to Mr. Birkin, himself, he (the speaker) exonerated him from anything in connection with the bad management of the company, and extended to him the hand of fellowship. His remarks were directed to other members of the Board. ("Hear, hear," and uproar.)

Mr. Birkin replied that he did not wish to separate himself from his brother directors as regarded any responsibility attaching to the Board.

Mr. James : I say for myself that it is a deliberate lie if anyone accuses me of sinister motives. If anyone said it to me personally I should know how to deal with him. (Uproar.)

The Chairman : I can only endorse every word that Mr. James has said.

Mr. Curtis Hayward then addressed the meeting at considerable length, and, in the course of his remarks he was interrupted by

Mr. James : I cannot afford to sit here all the evening. ("Order, order.") Gentlemen, you cannot yell me down, and I won't be yelled down. ("Chair, chair.") I cannot sit here—(uproar)—I won't and will not sit down." He is not touching upon the business of the meeting. (He is, sit down.) I beg your pardon, he is not. ("Chair, chair.") Any gentleman who is at all acquainted with public meetings—(uproar, and cries of "Sit down")—is perfectly well aware—"Chair, chair"—that at an extraordinary meeting of a company, no other business can be brought forward except that for which it is convened. ("Why don't you sit down?")

Mr. Reumen : I shall move directly that this meeting is illegal. (Laughter.)

A Shareholder (to Mr. Reumen) : Give some one else a chance, old man.

Mr. Reumen : I shall move that this meeting is illegal.

Mr. James proceeded to speak amidst great uproar and cries of "Sit down." He said : I'll not sit down for an everlasting noise ; gentleman, I will leave you, I'll have nothing further to do with you. I call upon the chairman to close the meeting unless you—(Uproar.)

The chairman : I think, gentlemen, it will be very much better for us to adjourn this meeting ("No, no,") I for one will not remain here to be spoken to in this way. (Noise.) We can adjourn this meeting till next week if you like. ("No, no.")

Mr. Reumen : But you would remain if you had had your own way. (Laughter.)

Mr. James here put on his hat to leave.

A Shareholder : Take off your hat.

Mr. James : I will not take off my hat ; when I meet gentlemen I take off my hat.

The Shareholder : Why don't you take off your hat ?

Mr. James : I will not sit here to listen to men who insult gentlemen—(Uproar.)

Mr. Curtis Hayward : You don't like to hear the truth

Mr. James : I say, as far as I am concerned, that is a deliberate lie—(a great uproar)—a deliberate lie, sir.

The Chairman (to Mr. James) : Resign ! resign !

Mr. James : I shall not resign.

A Shareholder : Resign !

Mr. James, No, I shall not resign. (Uproar.)

The Chairman : I think this meeting ought to be adjourned. ("No, no.")

Mr. James : Why this interruption, Mr. Chairman ?

Mr. Reumen : Because you are not willing to hear the truth.

The Chairman : We are quite willing to hear the truth.

Mr. James : I think you should listen. (Sit down.)

The Chairman : Will you adjourn the meeting till this day week ? (No, no.)

A Shareholder : I hope Mr. Hayward won't take up the time of the meeting. (Sit down, sir, sit down ; where's the chairman ?)

A Shareholder : I beg the chairman to stop the meeting. (Great uproar.)

Mr. James : I cannot wait here, it is a waste of time.

A shareholder : Good-bys, good-hye ; why did you come at all ?

Mr. James then left the room.

Mr. C. Hayward said he was certain that all those who had subscribed to the capital of the company did so on the faith of the statements in the prospectus, believing that the affairs of the company would be managed by competent men, and that due attention would be paid to reports coming from the other side. This, he considered, had not been done. He held that it was not necessary to have a highly paid secretary out in Vancouver, and that a clerk at £200 a year would be able to do all that was necessary. He concluded his remarks by moving that a letter should be sent from London to the local committee, to the effect that the meeting was of opinion that the statements made by the directors did not afford grounds for concluding that the local directors in British Columbia were responsible for the mismanagement of the company's affairs, and requesting the local directors to withdraw their resignations, and continue to act in that capacity.

The motion was seconded, and after some further heated discussion, carried.

Meeting of the New Vancouver Coal-Mining and Land Company, Limited.

A General Meeting of this Company was held on Tuesday, 19th ult., at 12, Old Jewry Chambers, London, E.C., Mr. John Galsworthy presiding.

The Chairman, in moving the adoption of the report and accounts, said the reconstruction was completed in March last, when the present Company took over all the property of the old. He congratulated the shareholders on the fact, because he considered they had benefited very considerably in their position. In the first place, they got rid of the inequality on their shares, and at the same time they got rid of the liability existing on a certain portion of the shares. They also got the advantage of a rearrangement of the balance-sheet. Further, they got more ample powers. Previously they were in a very cramped position with regard to their powers, because the articles were framed a very long time ago, and they found themselves often in a difficulty with regard to their powers. The reconstruction, however, had given them more elastic powers, and in all respects more satisfactory to the directors. As to what they had done since the reconstruction, for the four months since that period they had made a net profit of £4,995, and from the balance-sheet which the liquidator had sent them they would see that from last December to June they made £8,157 ; thus, for the twelve months together, the net profit was £13,152. That profit contrasted very unfavorably, he must admit, with the profits made in the six months from June, 1888, to December, 1888, which was a period of extreme prosperity for the Company. But for that prosperity they would have found themselves in an awkward position, but in consequence of that great profit, they were in an extremely satisfactory position. At the meeting in May he foreshadowed that they would have not such good prices, and it was partly that which induced him to press the adoption of the contract with Messrs. Rosenfeldt upon their consideration. That prognostication had been realized, for whereas in the six months ended when he was speaking they made a profit of \$4.50 per ton during the period ending June, 1889, the price had only been \$3.50. The profit from coal for the half year had been very small, owing to the bad range of prices at San Francisco. The output for the four months had been 58,000 tons, and for two months 47,000, making together 105,000. This was a very large output, and ought to have yielded much more profit, no doubt. There had been issued the same number of debentures as before ; all had been taken up, and they had not had one dissident, either from a shareholder or debenture holder, in carrying through the reconstruction. With regard to the state of the works, that was given very fully in the report ; but that day they had received a telegram from Mr. Robins, which carried that matter a little further. It was as follows :—"East Field Mine : No. 1 level (canal) continues in good coal 6 ft. thick. No. 3 level : No change. No. 3, South Field mine, in good coal, but working approaching two barren districts pierced by No. 4 slope. No. 2 South Field slope, stopped by fault, driving two drifts across lode No. 1 ; slope in fairish coal. North Field Mine : Driving four levels all in good coal, 4½ feet thick ; railway nearly graded ; began laying rails ; expect to ship cargo this year." The board had declared a dividend of £2 10s. per cent., making with the dividend paid in June, 5 per cent. out of the amount of profit transferred from the old company. The dividend did not affect the profits made by the new company ; that was hardly sufficient for them to expend in that way, looking to the fact that they had

had to spend so large an amount of money on capital works for the last year.

Mr. Joseph Fry seconded the motion, which was carried.

In reply to Professor Lambert, Mr. Tendron (another director) said that the amount that had been written off under the reconstruction scheme was £44,549.

Professor Lambert : That means we are £44,000 to the good.

Mr. Tendron : That is a very safe shot ; we are that or something more.

The Chairman then moved a vote of thanks to Mr. Samuel M. Robins, the Company's Superintendent, for the zeal and ability he had displayed in the management of the Company's affairs during the last half year.

Mr. Tendron, in seconding, spoke of Mr. Robins efforts in promoting the interests of the Company as indefatigable. The duties he discharged were multifarious. The only fault he (Mr. Tendron) had to find with him was that, having so many duties to discharge, and knowing the extreme confidence they placed in him, Mr. Robins thought that was sufficient for them as directors. Let him, however, say that their duties as directors could not be devolved, and he must obtain their counsel and sanction before certain matters were carried out. They trusted that he would enter fully into their views, and that they would not have to again make this the only complaint that could be urged against him.

Mr. Blundell seconded the resolution, which was carried without dissent.

Votes of thanks to Mr. McGregor, the mining engineer ; Messrs. Rosenfeldt, the agents at San Francisco ; and, finally, to the chairman and directors, terminated the proceedings.

The Production Of Coal In The British Colonies and Possessions—From

the annual Mineral Statistics just issued, it appears that the output of coal at the Cape of Good Hope during the year 1887 was 20,014 tons, of £56,047 value, while 5,600 tons were raised in metal, valued at £3,465, giving a total output for Africa of 25,614 tons. In India a total of 1,560,393 tons is given as the production, but the returns are stated to be incomplete. Of the total output of 3,750,459 from Australasia, New South Wales contributed 2,922,467 tons, as against 2,830,175 in the previous year ; New Zealand 558,620 tons, as compared with 534,850 tons in 1886 ; Queensland 238,713 tons, as against 228,656 tons in 1886 ; Tasmania 27,663 tons, as against 10,391 tons in 1886 ; Victoria 3,226 tons, as against 86 tons in 1886. Canada produced 2,115,031 tons, an increase on the previous year of 759 tons.

Dangers of Afterdamp.—The following

very valuable explanations and cautions are given by Mr. W. N. Atkinson, one of Her Majesty's inspectors of mines, in his report on the Hyde Colliery explosion, which occurred on the 18th January last. "It may not be out of place here to say a word of warning to persons who, without experience of large explosions, are called upon to enter a mine after an explosion has taken place. They should bear in mind that the resulting afterdamp is of an extremely poisonous nature, and that it may be fatal to men when its presence cannot be detected by the lamps, or directly by any of the senses. It frequently occurs that men proceed into the workings before the ventilation is restored, and are not aware of the poisonous nature of the atmosphere, until they are so far overcome as to be hardly able to retrace their steps into purer air, and sometimes they perish. It is probably carbonic oxide which poisons them. A minute proportion of this gas in the air is fatal to animal life. It is invisible, and has very little odour. The lamp, on which the miner chiefly depends for information as to the state of the air, is useless to warn him that carbonic oxide is present, even when in such proportion as to be rapidly fatal."

Memo. of Quartz Crushed and Yield of Gold by Nova Scotia Mines from July 1st to November 30th, 1889, as per Returns received to date by the Department of Public Works and Mines.

NAME OF MILL.	WHERE SITUATED.	JULY.			AUGUST.			SEPTEMBER.			OCTOBER.			NOVEMBER.		
		Quartz Crushed.			Quartz Crushed.			Quartz Crushed.			Quartz Crushed.			Quartz Crushed.		
		Tons.	ozs.	dwt.	Tons.	ozs.	dwt.	Tons.	ozs.	dwt.	Tons.	ozs.	dwt.	Tons.	ozs.	dwt.
Wm. E. Pye (Deputy Commissioner ...)	Sherbrooke .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	390	59	19	110½	17	13
Dufferin	Salmon River	800	157	....	800	219	....	550	145	10	600	103	....	800	149	10
Oldham Gold Mg. Co's	Oldham	132	69	....	95	173	4	.....	.....	.....	115	114	12	117	148	3
Lake Lode "	Caribou	88	39	....	70	36	11	53	30	7	.....	.....	.....	.....	.....	.....
Damas Touquoy's	"	420	58	2	435	22	9	343	16	1	408	17	11	390	50	18
Moose River Gold Mg. Co's .....	" .....	.....	.....	.....	163	50	19	17	2	16	105	15	13	175	19	4
Caffrey's .....	" .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	66	29	11	.....	.....	.....
Herbert Dixon's .....	" .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	66	12
Withrow	Uniacke	35	96	5	30	164	7	.....	.....	.....	20	122	5	20	81	12
Phoenix	"	125	16	7	200	21	5	235	24	2	225	29	6	232	31	5
Eastville .....	" .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	33	82	3	9	19	17
Oxford Gold Mg. Co's	Lake Catcha .....	.....	.....	.....	94	16	12	.....	.....	.....	199	67	9	67	165	12
McGuire's	Whiteburn	27	93	8	31	101	5	29	78	10	28	74	15	30	150	....
Whiteburn Gold Mg. Co's	"	153	148	2	116	134	17	110	126	17	153	146	14	.....	.....	.....
Egerton " "	Fifteen Mile Stream	152	78	2	168	77	11	183	130	15	.....	.....	.....	.....	.....	.....
Rockland	Stormont	269	161	....	191	94	6	244	137	16	227	148	5	.....	.....	.....
Brunswick Gold Mg. Co's	Tangier	50	5	2	.....	.....	.....	68	17	6	45	14	2	.....	.....	.....
Moseland	"	26	4	3	6	15	12	.....	.....	.....	.....	.....	.....	.....	.....	.....
Philadelphia Gold Mg. Co's	Brookfield (Queen's)	101	125	....	130	131	16	176	159	10	105	74	....	140	89	....
Kempt " "	Kemptville	25	24	10	24	23	....	24	23	10	.....	.....	.....	.....	.....	.....
Free Claim	Renfrew	20	35	15	.....	.....	.....	.....	.....	.....	51	71	10	.....	.....	.....
Millipseget	Millipseget .....	.....	.....	.....	9	3	15	1	1	15	.....	.....	.....	.....	.....	.....
El Dorado	Wine Harbor .....	.....	.....	.....	176	146	10	131	58	18	.....	.....	.....	.....	.....	.....
Northup Gold Mg. Co's	Central Rawdon	100	352	....	85	189	10	100	218	....	50	71	....	.....	.....	.....
Annand's	Montague	70	67	5	80	71	1	30	173	8	104	315	5	.....	.....	.....
Jos. Kayes'	"	4	2	18	15	29	13	.....	.....	.....	.....	.....	.....	.....	.....	.....
Parker & Douglas Co's	Malaga	140	48	8	131	60	13	100	28	10	146	52	8	141	50	15
Malaga Gold Mg. Co's	"	200	342	....	207	371	....	.....	.....	.....	405	512	8	255	301	14
New Brunswick	Harrigan Cove .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10	3	....	.....	.....	.....
Eureka	Ecum Secum .....	.....	.....	.....	65	35	10	.....	.....	.....	119	33	16	11	11	5
Neptune	Gold River	384	112	2	.....	.....	.....	117	54	13	.....	.....	.....	.....	.....	.....
Elmsdale Gold Mg. Co's	Elmsdale	10	.....	16	.....	.....	.....	.....	.....	.....	.....	.....	.....	41	.....	12

RECAPITULATION

July	2,036 ozs. 7 dwts.	October	7,158 ozs. 42 dwts.
August	2,190 " 11 "	November	1,353 " 12 "
September	1,428 " 4 "	Total	9,167 ozs. 6 dwts.

NOTE.—The returns for November are not yet complete, there still being some fourteen or fifteen mills to hear from. The value of the gold yield for these months is estimated at \$18 per ounce; or \$165,011.40.

PHOSPHATE.

In General.

"It is most satisfactory," says the *Trade Review*, "to notice the increased attention that is being paid to Canadian phosphates on both sides the Atlantic. Ultimately Canada must become the great source of supply, but, as we and others have repeatedly pointed out, there are too many interested people who insist upon making bonanzas out of the properties, or the enterprises with which they are connected. This has, very naturally, had a repellent, if not absolutely destructive effect, as capitalists who would be investors are not prepared to give the whole earth or its equivalent, for the few acres of apatite which these greedy persons control. The fact cannot be disguised or denied that several promising Canadian investments have been neglected for this very reason, but despite this, their intrinsic attractions are such as to have rivetted attention upon them and, through them, upon numerous other Canadian ventures of the same class."

A statement recently issued from the Comptroller-General's office of South Carolina, shows that the receipts by the State from phosphate royalties for the year ending Aug. 31, 1889, were \$206,805.91, with \$14,010.01 still due the State. The receipts for the previous year were \$186,993.87, showing an increase from that source of income of \$16,912.04.

The many friends of Dr. Penrose, lately connected with the phosphate industry of Canada, and now on the Geological Survey of the State of Arkansas, will be interested to hear of his movements. He writes from San Francisco, Nov. 29th:—"On my return to Little Rock in October I received orders to make a general report on the manganese ores of the Rocky Mountains and the Pacific coast. I had already made a report on the manganese of the Atlantic slope from the Gulf of St. Lawrence to the Gulf of Mexico, and had explored deposits in New Brunswick, Nova Scotia, Georgia, Arkansas and elsewhere. I left Little Rock the latter part of October and went first to Colorado and thence to Utah and Nevada. Then I came to California and after I have finished this State will go to Oregon, Arizona and Texas. For almost a month I was in the great deserts of Nevada, Utah and Western Colorado, which is one of the most dismal regions I ever travelled in." He gives a most graphic description of the weird scenery and the hardships of travel in a district where there had been no rain for three years. His indomitable energy seems to have found a sphere for its abundant exercise.

Templeton District.

We understand that the Blackburn mine has passed into the hands of an English syndicate, but the purchase price is not stated. The drift cut into the side of the big pit struck phosphate on the 15th of November, and is continuing a daily output of the finest ore. All the other "shows" are yielding large quantities, and are improving as the work progresses.

Kingston District.

The Foxton mine continues a steady output of 300 tons per month, its total production since the Foxton Mining Company purchased the property being officially stated at 1,600 tons. More

powerful machinery is now being fitted up at the mine, and more steam drills are to be put to work.

Perth District.

The Anglo-Canadian Phosphate Company continues its system of contract mining at Otty Lake and Bob's Lake. At the Otty Lake mines the "shows" are reported to be better than they have been for years, and fourteen new contractors have gone to work. At Bob's Lake a great number of productive seams are now opened and wait an enlargement of work that is soon expected to be made. The contractors continue to secure a very large output in proportion to the men employed, and the phosphate is found to be of a rich green color and of the highest quality as the work gets away from the surface.

Du Lievre District.

Mr. F. Stacey Shirley, New Bedford, Mass., proprietor of the grinding mills at Basin-du-Lievre, writes that he has perfected arrangements for doing a large business next season on his property. He says: "I find the interest in Canadian phosphate has become general, and I am thoroughly convinced that the crude rock itself, when finely pulverized, is a first class fertilizer, but we shall proceed to put it into form for immediate assimilation in the soil. I am already assured of sufficient sales to induce me to put in two new grinding mills, and if I can arrange for a supply of rock at reasonable rates, I intend to fit up the mill so as to produce from 50 to 80 tons per day. A chemist I am associated with has perfected a process for producing a cheap acid from waste products, which (if it proves as big a thing on a commercial scale as it does in laboratory tests) will create quite an industry in your section, and prove a valuable aid in furthering the success of my enterprise. I feel the time has come to create a business there, and mean to be one of the first in the new field."

Just as we go to press we learn of an unfortunate accident at one of the pits at the North Star, by which a couple of miners have been severely injured by a fall of timber. At time of writing it is not known whether the injuries are fatal.

There is nothing new to report from the other mines, at which work will be suspended as usual for a day or two during Christmas week.

Shipments, 1889.

Since our last report we have been advised of the following additional shipments of ground phosphate from Ottawa Valley mines to United States:

Buffalo, 200 tons.....	Value \$2,000
Chicago, 50 "	500
250 "	\$2,500

There have also been 480 tons shipped from the Lievrés district to Capleton for home consumption.

In our shipments to Europe under date of Nov. 9th, an omission of two tons in Messrs. Millar & Co.'s export was made.

The following shipments include the whole shipments to 18th December and an estimate of the total production from Canadian mines for the year 1889:

	Tons.	Bags.	Bbls.
Exported to Europe.....	23,542	132	2
Exported to United States.	4,176	—	—
Home Consumption.....	480	—	—
Estimated quantity held over at mines.....	5,000	—	—
Total production 1889....	33,198	134	2

MINING NOTES.

Nova Scotia.

In our August issue we published details of the gold production of the Province for the half year, ended 30th June, and in another portion of this issue, our readers will find details of the gold yield for the five months subsequent to that date. As will be seen, the returns for last month are not quite complete, some twelve or thirteen mills having yet to send in their returns, but it is apparent that the total yield for the year will be greater than 1888. We are much indebted to the Commissioner of Mines, and to his accountant, Mr. R. H. Brown for these interesting statistics.

Mr. R. G. Leckie, formerly Managing Director of the Cumberland Railway & Coal Company, has we understand, accepted the position of manager of the Londonderry Iron Co., taking office in the beginning of the year.

New Brunswick.

The Pope Manganese Company has made application for Letters Patent of Incorporation. The capital stock actually subscribed is \$75,000. The chief place of business is at Markhamville. The applicants are: Charles H. Converse, of Newton, Mass., merchant; William Pope, of Boston, Mass., merchant; Alexander Pope, of Boston, Mass., artist; William C. Pope, of Boston, Mass., merchant; Francis Ware, of Boston, Mass., merchant. Charles H. Converse, Alexander Pope and William C. Pope, three of the above named applicants, are to be the first or provisional directors.

Quebec.

Notice of application for incorporation has been made on behalf of the Canada Iron Furnace Co., Montreal. The capital is to be \$200,000, in 2,000 shares of \$100 each. The applicants are: P. H. Griffin, Buffalo, car wheel manufacturer; Robert Schott, Sheffield, England, steel manufacturer; George Edward Drummond, James T. McCall, Thomas J. Drummond, Montreal, metal merchants, and William John White, of Montreal advocate; of whom the said Patrick Henry Griffin, Robert Schott, George Edward Drummond, James T. McCall and Thomas J. Drummond shall be the first and provisional directors, the majority of whom are residents in Canada.

The United Asbestos Company, limited, of London, who own all the asbestos mines in Italy, have recently purchased the Frechette-Douville asbestos mining property at Black Lake. This property is well known for its excellent quality of asbestos, and has very greatly improved during the last season, at least two-thirds of the asbestos mined having been of No. 1 grade, of a quality not inferior to the best obtained from the Thetford mines. We understand that the United Asbestos Company's manufactures principally consist of the Italian fibre, which they claim to be superior to that found in Canada for many purposes, but they use also a certain quantity of Canadian asbestos, and the recent advance in the price has induced them to purchase a mine of their own. Seeing that they are the oldest manufacturers in Europe, this policy will place them in a very

strong position to meet the demand for all classes of material. We understand that, although the company has given some extensive orders for machinery to enable them to vigorously work their property, they will not have very much asbestos from their Black Lake mine for disposal to other manufacturers, and those therefore who require supplies should make early application. Mr. John J. Penhale, of Black Lake, has been appointed the manager. The chief offices of the company are at 161 Queen Victoria street, London, E. C.

Ontario.

"The Provincial Natural Gas and Fuel Company of Ontario" has made application for incorporation under the provisions of the Companies' Act (Rev. Stat. of Canada, 1886, Chap. 116.) The objects of the new concern are to utilize natural gas, oil and salt in the counties of Lincoln and Welland. The chief places of business will be at Welland and at Toronto. Capital \$500,000 in \$100 shares. The applicants are:—Peter McLaren, lumberman, Perth; John Fisher Wood, M.P., barrister-at-law, Brockville; Napoleon Alexander Coste, civil engineer, Amherstburg; Eugene Marius Antoine Coste, mining engineer, Toronto; Loftus Cuddy, banker, Amherstburg; Donald McGillivray, merchant, Port Colborne; Joseph Kavanagh, merchant, Ottawa; Hon. John Graham Haggart, Postmaster General, Ottawa; Edward Andrew Smyth, gentleman, St. Catharines; John Gale Dickson, gentleman, Niagara; Richard Harcourt, M.P.P., barrister, Welland; William Henry Curtis, contractor, Olean, N.Y.; James Morris Balderson, barrister, Ottawa; O'Brien Joseph Atkinson, barrister, Port Huron, Mich; Michael Andrew McHugh, barrister, Windsor; William McGregor, general dealer, Windsor; Maurice Bartholomew Twomey, merchant, Amherstburg; Auguste Emile Rondot, merchant Amherstburg, and Thomas John Watters, accountant, Ottawa. Peter McLaren, John Fisher Wood, Napoleon Alexander Coste, Eugene Marius Antoine Coste, Loftus Cuddy, Donald McGillivray and Joseph Kavanagh, are to be the provisional directors of said company.

Reduction Works, capable of smelting 70 tons per day, and crushing 150 tons, are at present in course of construction at Rat Portage.

Amongst the companies lately registered in London was the Murillo Silver mine, limited, registered by Granville, Smith & Co., Leadenhall street, E. C., with a capital of £60,000 in £1 shares. Object, to carry into effect an agreement for the sale to the company of certain freehold lands, containing in all about 80 acres more or less, together with the mines and mining claims or rights thereunder, lying in the territory of Thunder Bay, known as the Murillo Silver Mines Estate, and certain building, machinery, plant and effects.

The natural gas wells recently discovered at Welland are being energetically opened up. The pressure of the two wells, it is stated, is sufficient to allow the gas to be piped 100 miles.

* The Sydenham Mica and Mining Co. operating in the Township of Loughboro, is now employing some 50 miners in mining and preparing its mica for the market. The mines are furnished with an excellent plant. The output for the year has been fully up to expectations.

Port Arthur District.

Operations at the principal silver mines continue pretty much as usual with the exception

of the Badger, where a large reduction has been made in the force, owing to the closing down of the Stamp mill. The supply of water is very limited, and during the severe cold of mid-winter it cannot be operated to advantage. It is not likely that further shipments will be resumed until the railway reaches the mine.

The Beaver mine keeps steadily in full force, and the district at large will benefit much from the enterprise of the management in securing a diamond drill, which has already produced evidences of rich ore bodies at a great depth below the present workings. It is the intention to test the formations to a depth of 1,200 feet.

The Shuniah Weachu mine has been shipping another rich carload of ore to England, and at least one hundred tons equally as good will be ready in spring for the railroads. The last shipment realized nearly \$100 more per ton than was estimated. They are getting rich ore from the different points in the mine.

The West End management have just returned from Denver, Col., well pleased with the result of the sale of the last carload shipment.

Progress is being made at various other mines and prospects. The Crown Point mine is reported to have made a good sale of its first carload shipment, and good results are obtained at the Elgin mine. Work is also in progress in the Wolverine, Mink Mountain, Medicine Bluff and other good prospects.

Owing to the favorable open season good progress has been made on the Port Arthur, Duluth and Western Railway. The contractors, accompanied by W. H. Howland, ex-Mayor of Toronto, and others are going out to the end of the track at the Kammistiquia River, and from thence will take a trip through the mining region as far west as Silver Mountain. Some American capitalists have secured the famous Kakabeka Falls property, and are laying out a town site and making extensive preparations for smelters, pulp mills, and other factories—in which electricity produced from a water-power at least three times as great as Minneapolis can boast of—will play an important part. A branch line of railway to connect with the P. A. D. and W. Railway is now being located.

A smelter in such close proximity to the extensive silver, lead and iron deposits in this neighbourhood will fill a long-felt want.

What we want next is for the Government to permit the free entry of such mining machinery as is required in the district and not manufactured in Canada.

Gold Mining Supplies.

The principal depot in Nova Scotia, carrying the most complete assortment of first class goods, is

H. H. FULLER & CO'S,
41 to 45 Upper Water St., Halifax, N.S.

Our line comprises Explosives, Fuse, American and English Mill and Hammer Steel, Bar and Bolt Iron, Steel Wire Hoisting Rope, Hemp and Manilla Rope, Rubber and Leather Belting, Miners' Candles, Oils and Lamps, Miners' Tools, Machinists' Tools, Blacksmiths' Tools, and every requisite for the gold miner.

H. H. FULLER & CO.,

Halifax, N.S.

The delay in issue of Patents by the Ontario Government for lands in Hunter's Island in the Rainy River District is causing a great outcry amongst those Americans who invested heavily there years ago. No surveys are permitted there at present by the Government under the mistaken impression that valuable timber limits might go astray under the heading of mining lands. The boundary between the Thunder Bay and Rainy River districts should be surveyed at once to prevent conflicting claims.

About twenty-four miles south-west of Port Arthur, in the Township of Crooks, a valuable deposit of native copper has been located, and considerable prospecting and developing is now going on. The fact that the ore averages from 8 to 10 per cent. of copper and is readily accessible to a good harbour on Lake Superior gives the find unusual attraction, and enquiries from capitalists are already numerous.

Manitoba and North-West Territories.

The Saskatchewan Railway and Mining Company will ask for an extension of their chartered line from its present terminus at Saskatoon, crossing the South Saskatchewan river and running north-easterly to Fort a la Corne, thence to the crossing of the Saskatchewan River at Grand Bend, thence north-easterly by the most favorable route to a junction with the Hudson Bay Railway (projected); also from the terminus in a northerly direction, crossing the North Saskatchewan, thence northerly to Green Lake, crossing Beaver River to Water-Hen River onward.

The London *Morning Post* had an interesting article the other day on the anthracite coal mines which the Canadian Anthracite Coal Company has been exploiting in the heart of the Rocky Mountains. In the course of its remarks it says: "Previous to November last the Admiralty employed upon the Pacific coast the bituminous coal of Vancouver Island, with the result that British men-of-war could be tracked by means of the black smoke for a distance of as much as 70 miles at sea. The advantage to our Pacific coaling stations of there being large deposits of smokeless anthracite within two days' railway journey of the coast is obvious. Moreover, the anthracite coal crops out in places along the mountain side, so that it is largely worked by horizontal tunnels, which are comparatively inexpensive in relation to vertical shafts, and the fact that the mines are close upon the main line of the Imperial Inter-Oceanic route of the Canadian Pacific Railway is another circumstance of prime importance. But the value of these Canadian anthracite fields is not based upon Imperial grounds alone, for as the ocean traffic between Vancouver and Australia, India, China and Japan undergoes its inevitable development, there is bound to arise a great and increasing demand for the smokeless fuel of which such large deposits exist in the Pacific territory of the British Empire. To this must be added the ever growing need for industrial purposes, a need that will make even Chicago, St. Paul and Minneapolis consumers of the Canadian anthracite. The United States Government is fully alive to the value of smokeless fuel in the naval marine, and it recently chartered two vessels to carry 5,000 tons of anthracite coal to the harbor of Pago Pago, in the Samoan Islands, which it is proposed to use as an American Government coaling station for vessels cruising in Pacific waters."

Apropos of the above, Mr. Macleod Stewart, president of the Anthracite Coal Company, wires to a member of the company from St. Paul, denying the telegram from Eau Claire which states that the deal with the English capitalists is off. Mr. Stewart recently returned from England with a modified cash proposition for the entire property. To the new terms the American stockholders unanimously agreed, and an option was granted Messrs. Stewarts, giving them control of the property. Negotiations are being rapidly closed with the English syndicate, whose capital is stated to be one and a half millions.

British Columbia.

The coal trimmers of Nanaimo have formed a union for the express purpose of keeping this work among themselves and to meet all the requirements of vessels arriving in that port, so that there will now be no delay in obtaining trimmers, as has very often happened. Recently there has been a number of miners, who, not being satisfied with working in the mines, are very often to be found seeking the trimming work. The trimmers are also endeavoring to obtain the right of trimming at the Bay, where the Chinamen now receive 50 cents an hour for mail vessels and 40 cents for other boats. A building will be erected near the wharf, so that the men can be on hand at a moment's notice, both night and day.

There is some talk of the erection of another smelter in Kootenay, so located as to suit the mines at Golden and Donald. Mr. McCarthy of Calgary, is the moving spirit.

Gold Commissioner Crimp of Cassiar, reports that the season just closed has been most satisfactory. The Bonanza on Dease creek, has done the best, panning out from \$7,000 to \$8,000. On the Tibbet creek the McVicar & Foster Company's claim has also done well, while Quartz creek has fully justified expectations. In all, Cassiar has produced between \$12,000 and \$13,000 worth more gold than last year. Had it not been for the rain and freshets which washed out the low lying claims, the returns must have been very considerable.

Messrs. Dunsmuir & Sons, proprietors of the several Wellington collieries, are most energetically prosecuting exploratory work at the coal lands purchased by them from Messrs. Horne and Sabiston, and situated between the East Wellington colliery and this city. It will be borne in mind that several years ago Messrs. Horne and Sabiston, together with Messrs. John Dick and Jacob Blessing, opened up a seam on this property and several hundred tons of coal therefrom were sold in this city. Then Messrs. Dunsmuir & Sons purchased the coal rights, amounting to between 500 and 600 acres. For some short time past the new proprietors have been running a tunnel or drift to strike the main seam of coal. They have already reached the main seam, and expect in the next 100 or 150 feet to strike the main seam. The work is under the immediate superintendence of Mr. Adam Ross, an experienced miner and overman. In a few months, at the outside, it is expected that this property, which has been facetiously styled "Jingle Pot," will be in a position to add materially to the general output of the Wellington collieries.

The following were the shipments of coal from Nanaimo for the month of November:

The New Vancouver Coal Co....	15,223	tons.
Dunsmuir & Sons.....	22,102	"
East Wellington Colliery.....	5,506	"
Union Colliery Co.....	4,300	"
	47,131	"

The shipments from the two camps at Kootenay Lake last summer were:

	Tons.	Silver per ton.
Number One.....	130	85 oz.
Little Donald....	66	95 "
Spokane.....	44	35 "
Della.....	16	105 "
Sky Line.....	12	225 "
Gallagher.....	13	126 "
Krao.....	11	90 "
Silver King.....	60	300 "

These values do not include the lead, which, of course, will enhance values considerably. This return may appear very small, but when it is considered that the claims are being worked, as yet, only in a small way for development, and that only 10 per cent. of it can be shipped owing to the cost of transportation, these figures, after all, are very suggestive. Transportation to the lake is quite expensive, the means being by pack train.

Mining in the immediate vicinity of Barker-ville has been good during the year, though scarcity of water has prevented better returns, but it is expected that the gold yield for the district generally will not be less than that of 1888. The test works are not yet completed in all details, but the balance of the material for the chlorination plant has arrived, and by this time will be in position.

Cheaply Mined Iron Ore.—The Dunn Florence and one or two mines in addition to these, being wrought on the ranges south of Ishpeming, are doing excellent work. At the Florence, ore is sold in the cars for \$2.25 per ton, and it is said the company netted about \$100,000 from its last year's product. The mine is a non-Bessemer, producing an ore that is liked by furnace-men. It possesses a large deposit of ore which thus far, by reason of its nearness to surface, has been very cheaply extracted. As the mine grows in depth, the cost of production will increase considerably and profits will be reduced from what they now are, but still there will be a fair margin of profit, as the property possesses a wonderful amount of ore. The Dunn is making a splendid record, and has a magnificent storehouse to draw from.

Iron Ore in Great Britain.—Iron ore is produced in 29 counties of England and Wales, 12 counties of Scotland, and in one of the counties of Ireland. The production has fallen off seriously during recent years, and some of the older centres of production are becoming extinct, if they are not so already. Over 30 per cent. of the British ore requirements is now supplied from foreign sources, and the iron industry flourishes, though the ore is admitted free of duty.

South African Gold Production.—South Africa is fast looming up as a source of gold supply. The exports from the Cape and Natal for the eight months ended with August, aggregated \$4,695,000 against \$3,225,000 for the like eight months of 1888. The crushings for the Witwatersrand mines for third quarter of present year aggregated 64,387 ounces worth say, \$1,125,000, the increase averaged \$1,250,000 last month.

Gold Milling in the Black Hills.

(H. O. Hoffman, Rapid City, Dakota.)

(Continued from November issue.)

The latter corresponds with the height at which the issue of the pulp occurs. In the Homestake mortar the issue is raised by the insertion of the chuck-block 16½ inches above the foot of the dies, thus giving, with a shallower mortar, a deeper issue of pulp than the Caledonia mortar.

Dies.—The Homestake management casts its own dies. The quality of iron used is between gray and mottled, the top of the cylindrical part being chilled. The foot-plate has bevelled corners, and is 10 inches long, 10½ inches wide and 1½ inches thick. The cylindrical part or "boss" is 9 in. in diameter and 5 in. high. The level of the die is 10 in. below the discharge which takes place over the chuck block. The die weighs 121 pounds (one-seventh of the weight of the stamp) and lasts about six weeks, crushing 189 tons. By that time the cylindrical part has become slightly convex, and is worn down to 2 in. from the foot-plate. Its weight has then been reduced to about 30 pounds; thus 48 pounds of iron are consumed for every 100 tons of rock that are crushed.

The Caledonia mill buys its dies outside. They are of chilled white iron. The foot-plate has also bevelled corners, is 10 in. wide by 9½ in. long and 1½ in. thick. The cylindrical part is 8 in. in diameter and 5½ in. high. While the dies in the Homestake mortar fill its bottom completely, those of the Caledonia fit perfectly in the width only, there being a 3-in. space in the length that has to be divided up between the five dies. The distance from bottom of screen to top of die is 6 inches. The die weighs 160 pounds (about one-fifth of the weight of the stamp) and lasts three months, crushing 300 tons of hard rock. The cylindrical part is then worn down within 1 in. of the foot-plate. The worn-out die weighs 38 pounds, making the consumption of iron 40 pounds for every 100 tons of rock.

Amalgamated Copper Plates are placed along the entire length of the mortar. In the Homestake mortar, one plate is set to the discharge opening; in the Caledonia mortar, there are two plates; one under the discharge, the other beneath the lip of the feed opening.

The Homestake mills use the so-called chuck-block (half elevation, Fig. 2 and Fig. 3), placed against the lower flange and the two side-flanges of the discharge. The chuck-block consists of a 2-in. plank, bolted to the back of a 1½ in. board, and extending from 2 to 2½ in. above it. Its inside upper edge is rounded off, and over this, and along the inside face, a 3-16 in. copper plate is fastened with iron screws. The recess formed on top of the front board, 1½ in. wide and from 2 to 2½ in. deep, is taken up by the lower part of the screen-frame. Between this and the front board is placed a strip of carpet to form a tight joint. The frame is held in place by a vertical piece of flat iron bolted to the centre of the front board, a horizontal wedge being driven between the two. The front board has an iron facing along its lower half, and two vertical strips towards the ends, to protect the wood against the two horizontal and the two vertical wedges with which it is fastened to the mortar. To the back (beneath the 2 in. plank having the sheet copper), is tacked a strip of rubber cloth, which helps to make a tight joint between wood and flange of mortar. Two chuck-blocks, of different heights are in use. When the dies are new, a chuck-block 7 in. high is inserted; when they have

worn down 2 in., another chuck-block, 5 in. high replaces it. Thus the height of discharge is kept nearly uniform. The distance between the face of the shoe and the chuck-block (2 in.) is rather small. The violent motion of the battery-water drives the sands against the copper plate and scours off amalgam that has been caught on it. Thus comparatively little amalgam can settle on the plate. Wooden chuck-blocks last six months. After this time the coppers have to be removed and put upon new blocks, or they are scraped very carefully, put aside, melted and sold. Mr. R. Graham, the millwright of the Homestake mill, has therefore replaced, in his mill, the 2-in. plank, to which the copper plate is screwed, by $\frac{3}{4}$ in. iron, to which the 3-16 in. copper plate is rivetted with copper rivets. The face of the $1\frac{3}{4}$ -in. wooden front board is covered with $\frac{1}{4}$ in. iron; thus the distance between face of shoe and Graham chuck-block is $3\frac{5}{8}$ in. instead of 2 in. This iron chuck-block lasts as long as the mortar, and more amalgam collects on it than on the wooden one. Of the free gold recovered, 55 per cent. is caught on this inside plate.

The reason that the Caledonia mill has amalgamated copper plates at both front and back is that the ore milled is not oxidized at all, which makes it harder to extract the gold. The aim is to keep the pulp longer in the battery and thus counteract the refractory character of the ore. The plate in front is 5 in. broad, the one at the back 8 in. Both are made of $\frac{3}{16}$ in. copper and are simply bolted to the mortar, the lower edge of the plates being 9 inches above the foot of the dies. Of the free gold recovered, 60 per cent. is caught on these inside plates.

Screens.—Both diagonal-slot and wire screens are used in the district. With the exception of the Father de Smet mill, which uses partly No. 30 brass-wire screens, all Homestake mills use diagonal slot screens made of heavy Russia iron. The needle number is 7, corresponding to a 30-mesh wire screen, the width of the slot being 0.024 in. The thickness of the iron is $2\frac{1}{2}$ (American wire-gauge) and its weight 0.987 lbs. per sq. ft. The slots are $\frac{1}{2}$ in. long and there are eight (formerly only seven) to the inch. The punched surface of the screen is 48 x 7 in.; there is a margin of 1 in., making the entire screen 50 x 9 in. A screen lasts two weeks. The wooden frame is 4 ft. 4 in. long and $11\frac{1}{2}$ in. deep, and has a strengthening rib, $6\frac{1}{2}$ in. long, down the centre. In fastening the screen to the frame, the lap is first tacked on, to hold it in place, then a piece of rubber cloth, 2 in. wide, is placed over it, small holes are punched through rubber and lap of screen and both are nailed to the wooden frame. The screen is placed on the frame with the rough side facing the mortar. On the outside of the frame are fastened, by means of two screws, three iron facings, $\frac{1}{2}$ in. x 9 in. and $\frac{1}{8}$ in. thick, which protect the wood from the one horizontal and the two vertical keys that serve to wedge the frame against the chuck-block and the planed flanges of the discharge.

Some time ago experiments were made with screens of aluminium-bronze, which proved extremely satisfactory. The bronze contains, according to a letter from the Cowles Electric Smelting and Aluminium Co., 5 per cent. aluminium, 95 per cent. copper and a trace of silicon, and is furnished in unperforated sheets at 45 cents per pound. When new it has a golden color, which it loses with use. The width and length of the slots are the same as in the ordinary screen, but there are nine slots to the inch instead of eight. The sheet is 0.035 in. thick. This screen lasts six months

and does not break (while the Russia-iron screen breaks in two weeks). The wear is uniform over the entire surface, the slots enlarging to No. 5 $\frac{1}{2}$ needle. The screens are then past use. The bronze, however, is not lost, but can be melted down and made into new screens. It is the intention of the Homestake management to introduce this screen throughout all its mills. This would have been done already, had not the contracts for Russia-iron screens been made before the bronze screen was tried.

GOLD-MILLING IN THE BLACK HILLS.

TABLE II.—Dimensions, Power, Batteries, and Product.

Mill.	Engines.			Boilers.		Dimensions.			5-Stamp Batteries.			Product.		
	Type.	Cylinder.	Stroke.	Number.	Cords of wood per 24 hours.	Length.	Width.	Vertical dist. of crusher-floor above bottom of ore bin. Ft.	Distance between dies. Feet.	Weight of stamps. Lbs.	Drops. Inches.	No. of drops per minute.	Tons crushed per stamp in 24 hours.	Tons milled in one year.
Homestake,	A	20	42	2	11	100	80	14 $\frac{1}{4}$	44 $\frac{1}{2}$ ^a	850	9	85	4.5	96,790 ^c
Golden Star,	B	20	60	4	14	120	88 $\frac{3}{4}$	23 $\frac{3}{4}$	36 ^d	850	9	85	4.5	146,565 ^e
Highland,	C	26	60	4	14	112	92	22 $\frac{3}{4}$	46 ^d	850	9	85	4.5	146,013 ^f
Deadwood,	A	20	42	2	11	112	46	22 $\frac{3}{4}$	k	850	9	85	4.5	216,361 ^f
Golden Terra,	A	18 $\frac{1}{2}$	42	2	11	112	46	22 $\frac{3}{4}$	k	850	9	85	4.5	\$639,229 ^g
Father de Smet,	A	20	42	2	11	68	60	40	36 ^f	850	9	85	4.5	\$295,816 ^h
Caledonia,	D	20	30	2	11	84	46 $\frac{2}{3}$		k	850	12	74	3.3	\$4,020 ⁱ

The Caledonia mill uses No. 24 brass-wire screens, the thickness of the wire being No. 26, and the screening surface 48 x 53 $\frac{1}{2}$ in. The screen lasts one week. It is fastened to a simple wooden frame, 53 x 12 $\frac{1}{2}$ in., the horizontal sides being 3 $\frac{1}{2}$ in. wide, the vertical sides 2 $\frac{1}{2}$ in. Three wooden ribs, 1 in. wide, divide the screen-surface into four panels and thus prevent it from bulging out. The fastening of the screen to the frame and the wedging of this against the mortar are done as at the Homestake, except that there the screen-frame is placed on the chuck-block, and here it is keyed against the

lower rim of the mortar discharge. The Caledonia uses wire screens because, although its stamps drop 3 in. farther than those of the Homestake mills, the splash is not so great, by reason of the greater width of the mortar and the space taken up by the amalgamated copper plate below the feeding-lip. The force of the splash in the narrow Homestake mortar is thrown entirely against the screen; that of the wider Caledonia mortar is divided between the screen in front and the recess at the back. Thus the slot-screen would clog, while the wire screen allows the pulp to pass through free.

The upper part of the discharge of both classes of mortars, above the screen-frames, is closed either by an inch board or by a canvas curtain, or piece of old belting, suspended from a lath. This curtain or belt hangs down and meets the screen in the mortar. It has the advantage over the board in that the amalgamator can readily pass his hand into the mortar and remove any chips of wood, etc., floating on the water or adhering to the inside of the screen.

We have have seen that in the Homestake mortar the pulp is driven with some force against the screens. In order to break its fall upon the apron-plate, a splash-board is fastened to the frame of the latter, thus preventing any amalgam collected there from being washed away. The Caledonia motion has no splash-board, as the pulp does not pass the screens with sufficient force to endanger the amalgam collected at the head of the apron-plate.

Stamps.—The stamps (Figs. 1, 2 and 3) used by both companies are of the ordinary pattern. They weigh 850 lbs., about 16 lbs. to the sq. in. of crushing-surface, and their centers are 9 $\frac{3}{4}$ to 10 in. apart. For dimensions and other particulars as to the different parts, see the table already given.

The stem tapers 6 in. at both ends, so that when it breaks, usually where it enters the head, it may be reversed. At the Homestake mills, a stem lasts about three years before new ends have to be welded to it. The Caledonia mill requires for its 60-stamp mill five stems yearly.

The tough cast-iron head is without the wrought-iron rings which are often used at the upper or lower end. It has the usual keyways for the removal of stem and shoe. These are parallel instead of being at right angles, as is usual. To fasten the head to the stem, the latter is let down through the guide holes and the socket of the head placed directly beneath it. The stem is lifted and dropped and driven with a hammer, if necessary. Then the stem and head together are dropped several times on a piece of timber placed beneath, until they are quite firm. At the Homestake mills, a head lasts five years, after which the socket has become so enlarged that the stem cannot be securely fastened in it any longer. The Caledonia mill requires one head a month.

Both managements buy their shoes from outside foundries. To fasten the shoe to the head, the shank is surrounded by small wooden wedges tied around it with a string; the shoe is put in place; and stem and head are allowed to drop. Thus the shank is wedged into the recess of the head, and by raising the whole and allowing it to drop several times, the shoe becomes thoroughly fastened in. To prevent it from injuring the die, a piece of planking is placed on the latter. At the Golden Star mill, a very neat arrangement is in use for fastening the wooden wedges to the shank of the shoe. After the wedges have been placed around the shank, a strip of canvas is wound around them and tacked to each wedge, forming a sort of collar,

which can be easily slipped over the shank of a new shoe. This simple arrangement saves a great deal of time and labor on clean-up days, when a good many shoes have to be replaced.

After being some time in use in the battery, a shoe becomes slightly concave at the base, but wears, on the whole, more evenly than the die. At the Homestake mills, a shoe lasts two months, crushing 270 tons of rock. It is then worn down to two inches from the base of the shank and weighs 40 pounds. This corresponds to a consumption of 37 pounds of iron for every 100 tons of rock crushed. At the Caledonia mill, a shoe lasts three months and crushes 300 tons. It is replaced when worn down to one inch and weighs 35 pounds, which corresponds to a consumption of 35 pounds of iron for every 100 tons of rock. It may be asked why the Caledonia mill, which buys both its shoes and dies, does not use steel, which is so much more durable, and consequently cheaper, especially if the heavy freight charges are taken into consideration. The answer is that because steel lasts so much longer than iron, steel shoes and dies would continue in use after they had become uneven. This would reduce the crushing capacity of the battery, and thus in the end there would be no saving at all.

In order to secure the tappet to the stem, the wrought-iron gib is first put into the recess. The tappet is then slipped over the stem, and when it has reached the desired place, is secured by keys which pass at right angles between the gib and the iron shell of the tappet surrounding the stem. All the tappets of the Homestake mills have two keys; those at the Caledonia have some two and some three.

Both faces of the tappet are used as working faces. In wearing down they become uneven and ridges are formed. The tappet then has to be removed and planed off on a lathe before it is fit for further use. Once in three years, when the two faces have worn down $1\frac{1}{2}$ inches, the tappet is replaced by a new one. A tappet rarely splits. Case-hardened tappets and cams have been tried at the Homestake mills in the expectation that the hardened working surfaces would last longer; but the tappets cracked and became useless, as they could not be well planed off. Steel tappets and cams have not been tried. It takes from six to eight hours to change the tappets and cams of one battery.

At the Homestake mills, the drop is 9 in., the number 85 per minute, and the order 1, 3, 5, 2, 4. At the Caledonia mill the height is 12 inches, the number 74, the order 1, 3, 5, 2, 4 and 1, 4, 2, 5, 3. The Caledonia mill has such a hard rock to pulverize that it is forced to have a higher drop and consequently a smaller number of drops per minute. That the Caledonia mill has two different orders of drop is quite unimportant, as they both comply with the same requisition, viz., that no stamp shall be immediately followed in falling by either of those next to it.

Cams and Cam-Shaft.—The stamps are lifted by cams fastened to a shaft which rests in boxes. These are supported by shoulders in the front of the battery posts to which they are bolted. Ten cams are keyed to one cam-shaft, which is set in motion by the cam-pulley.

The cams are double-armed. They are of tough cast-iron and have the form of the involute of a circle (slightly modified at the end), the radius of which is equal to the distance from the center of the cam-shaft to the center of the stamp. The hub of the cam, which is on the off-side of the stem, is not strengthened with the wrought-iron band shrunk on it, which is often used, but is cast sufficiently thick to stand

the strain. At the Homestake mills the cams have a working face 2 inches wide and $3\frac{1}{2}$ inches deep. The strengthening rib, beginning at the end of the cams, gains in depth towards the hub, where it is $9\frac{1}{2}$ inches deep. The hub itself is $3\frac{1}{2}$ inches thick. The distance from centre of hub to end of cam is 17 inches. A cam lasts three years. The cams of the Caledonia mill differ only slightly from those of the Homestake mills. The face is $2\frac{1}{2}$ inches wide 2 inches deep, the strengthening rib at the hub $10\frac{1}{2}$ inches deep, the hub $3\frac{1}{2}$ inches thick, the distance from centre of hub to end of cam 19 inches. The cams, being made of car-wheel iron, last over four years. From ten to fifteen a year are required.

The cam-shafts are of tough wrought-iron, turned down in a lathe. They have one longitudinal key-seat. The keys with which the cams are fastened to the shaft are of steel and are hand-fitted. Wrought-iron keys lose their shape too quickly, and machine-fitted keys get loose very easily; a great disadvantage. It takes ten hours to replace a broken cam-shaft, supposing that the keys have been already fitted. This ought always to be done, as the fitting of each key-seat takes about one hour. A well-appointed mill always has on hand several cam-shafts, with the necessary cams and keys ready for use. The cam-shafts of the Homestake mills were formerly made $4\frac{1}{2}$ and $4\frac{3}{4}$ in. in diameter and lasted about five years. Now the tendency is to make them stronger. The largest in use at present are $5\frac{3}{8}$ in. in diameter, and good for ten years. The distance between centres of cam-shaft and stem is $5\frac{1}{2}$ in. The cam shaft of the Caledonia is $4\frac{1}{8}$ in. in diameter and its centre is $6\frac{1}{2}$ in. distant from the centre of the stem.

The cam-shaft pulleys, at the end of the cam-shafts, vary slightly in the different mills. At the mills of the Homestake they are 6 ft. and 7 ft. 5 in., at the Caledonia mill 7 ft. 4 in. in diameter; the face is usually 15 in. wide. The pulleys are of wood. Iron could not stand the continuous shocks caused by the dropping of the stamps, and would also be too heavy. The pulley is built on a cast iron hub with flanges, and keyed to the cam-shaft. When put in place, the shaft is made to revolve and the face of the pulley turned off to the desired form, that it may be perfectly true. The cams are lubricated with axle-grease. To prevent any of this from dropping on the apron-plates, hindering amalgamation, a curtain is stretched out beneath the cams to catch any particles of grease that these may throw off while in motion.

Crushing Capacity.—The crushing capacity of a battery depends on the efficiency of the stamp (that is, the number of foot-pounds developed), the character of the rock under treatment and the discharging capacity of the mortar (that is, the height and size of the discharge, the character of the screen and the width of the mortar at the discharge). The Homestake stamp weighs 850 lbs. and drops 9 in. 85 times per minute; thus it develops 78,030,000 foot-pounds in twenty-four hours crushing $4\frac{1}{2}$ tons of rock, or one ton for every 17,340,000 foot-pounds developed. The Caledonia stamp weighs 850 lbs. and drops 12 in. 74 times per minute, developing 90,576,000 foot-pounds in twenty-four hours, crushing 3.3 tons of rock, or one ton for every 27,447,272 foot-pounds developed. Thus, although the efficiency of the Caledonia stamp is greater than that of the Homestake, it crushes lessore. There are several reasons for this. First, the character of the rock, which is much harder than that at the homestake; second, the width of the mortar at the discharge (16 in.

against $13\frac{1}{2}$ in.); third, the 2-in. recess for the 8-in. amalgamated copper plate below the feed, which is absent at the Homestake mortar. From the lower discharge of the Caledonia mortar (6 in. against 10 in.) a greater crushing capacity would naturally be expected than from the Homestake mortar. The above reasons will explain why this fails. The smallness of the Caledonia screen (258 sq. in. against 376 sq. in.) may be assumed to be counterbalanced by its character (Caledonia No. 24 wire against Homestake No. 7 slot, which corresponds to No. 30 wire). The Caledonia Co. claims that more gold is recovered by its slow method than by the more rapid one of the Homestake. This point could only be definitely settled by exact tests.

Apron-Plate, Mercury-Traps, Sluice-Boxes.—In order to save the fine particles of gold that have not been caught on the inside copper plates and to collect any amalgam and quicksilver that have passed through the screens, an amalgamated copper plate, the apron-plate, is placed in front of the mortar. The motion of the battery-water, caused by the dropping of the stamps, throws with the drop of each stamp some pulp against and through the screen. This, passing over the lip of the mortar, flows in small waves over the apron-plate. During the slight interval between these waves any heavy particles of the pulp (quicksilver, amalgam or fine gold) passing over the amalgamated plate have a chance to settle upon, adhere to, and combine with it. The plate consists of one sheet of copper, nearly as wide as the discharge of the mortar, fastened with iron screws to the inclined wooden table beneath it. In all the Homestake mills (except the Deadwood and Golden Terra, where it is 12 feet long) the copper plate, $\frac{3}{8}$ in. thick, is 10 feet long, falls 2 in. to the foot, and discharges into a copper-lined trough, leading to the mercury-trap. The apron-plates of the Caledonia are 8 feet long, $4\frac{1}{4}$ ft. wide, and the copper is $\frac{1}{8}$ in. thick. They have the same fall. The wooden table extends 4 feet beyond the end of the copper plate, at the same time narrowing to a width of 4 feet. It has a 1-in. rib down the centre and is overlaid with two blankets, 5 ft. wide and 22 in. long, the upper overlapping the lower. On these the heavy sands collect. Each is washed every half hour in a tank. These blankets last six months. Carpets were tried, but they frayed and had to be thrown out after one month. The pulp from the blankets flows into the mercury-traps, one being placed in the middle of the discharge for every plate.

The plates are of Lake copper, furnished to the mills ready for use, and do not require any annealing to make them porous. They have, however, to be flattened with wooden mallets to make them lie smoothly on the wooden table and to remove any inequalities produced during transportation. At the Homestake mills they are first scoured with sandpaper, followed by emery cloth or with tailings and a wooden block 4 inches square, or with a grindstone, until the face is perfectly bright. If necessary, the sand is moistened with a weak solution of potassium cyanide, and spots are often removed with dilute nitric acid. The surface of the pure metallic copper receives a solid coat of potassium cyanide, which is applied repeatedly as a strong solution by means of a soft paint brush. After two days the mercury is sprinkled on this cyanide coat and rubbed into the plate with a moist cloth and tailings. When the plate is thoroughly amalgamated it is put into place and is ready for use. More than the usual amount of mercury is added to the mortar, that the new plate may become normal. This takes from two

to four weeks, during which time the plates are continually discolored by copper salts. To get these into solution, potassium cyanide or ammonia is added to the battery-water. At the Caledonia mill the procedure is similar, only more care is taken to saturate the plate with mercury before it is put into use. Only the ordinary quantity of quicksilver is then added to the mortar with a new plate. In none of the mills are the plates coated with amalgam before they are put to use, nor are there any silver-plated copper-plates used in the district.

The mercury-traps, through which the pulp passes on leaving the apron-plates, save amalgam and quicksilver not collected on the apron-plates. There are additional traps at the termini of the sluice-plates outside. At the Homestake mills, until about three years ago, the pulp flowed from the apron-plates directly over the sluice-plates into the waste flume. Then the traps were introduced. How important this simple contrivance is, can be seen from the fact that in the Homestake 80-stamp mill there are recovered every month, by the inside traps, 80 oz. of amalgam and 144 of quicksilver; by the outside traps, from 10 to 12 oz. of amalgam and 40 of quicksilver. These traps are emptied only once a month—on the fifteenth. If they were emptied twice a month, on clean-up days, a still better showing could perhaps be made. At the Caledonia the traps are emptied daily, when the apron-plates are being dressed; this is done because of the accumulation of concentrates.

At the Homestake mills the inside trap consists of a wooden box, with copper-lined bottom 14 in. long, 17 in. wide and 24 in. deep. It contains three sliding wrought iron plates, parallel with its short sides. These are placed $2\frac{1}{4}$ in. apart, the centre one extending to the bottom of the box, the others to 3 in. above it. The pulp flows under the first, over the middle one, and again under the third. The outside trap is larger. The wooden box is 48 in. long, 14 in. wide and 48 in. deep. It has three partitions set $10\frac{1}{2}$ in. apart, reaching from the bottom of the box up to $1\frac{1}{2}$, 3 and 4 in. below the level of the inlet, the outlet being 6 in. below this. In the middle, between two wooden partitions, is let down a sliding wrought-iron plate $\frac{3}{8}$ in. thick, reaching to 3 in. from the bottom of the box. The Caledonia traps are much smaller, since there is one for each apron-plate.

The sluice-boxes, receiving the pulp from the inside traps, are simple wooden troughs with copper lined bottoms. At the Homestake mills, they are from 8 to 10 ft. long, 18 in. broad and have a fall of 1 in. to the ft. The copper used is $\frac{1}{8}$ in. thick. At the Caledonia mill they are 8 ft. long and only 8 in. broad as less pulp passes through them. The main sluice into which they discharge is 2 ft. square.

Steam-Stamps.—The Homestake Co. has just erected an improved ball stamp. This is a new experiment in gold milling. The steam-stamp is successfully used for crushing native copper-ores at Lake Superior, and sulphide copper ores at the Anaconda mine, Montana. The results of its application to gold ores may be given in a future paper.

VI. LABOR IN THE MILLS.

All the heads of the different departments are responsible to the superintendent. The mill proper is in charge of a foreman, thoroughly acquainted with every detail of work. One foreman often has the general charge of several mills, as with the Homestake and Deadwood Terra companies. Next comes the millwright, who sometimes has, as in the Homestake mill,

an assistant called the pipe-fitter. The millwright combines the trades of carpenter and machinist. His duty is to make the guides, put them in place and keep them in order; to exchange cams and cam shafts, fasten any cams that have become loose, make and replace screens, make and repair chuck-blocks, to reserve and exchange shoes and dies of crushers and to look after all the piping in the mill; in one word, to erect and keep in order every part of the mill for which any mechanical knowledge is required. One of his duties, for example, consists in lining all the shaftings and in babbitting their boxes.

In this connection might be mentioned a method of lining shafts which originated with Mr. R. Graham, the millwright of the Homestake Company, and which has proved to be quick and effective. When a shaft is to be lined, the boxes are placed so as to be approximately in line. The lower bearing, which is to receive the shaft, is loosely packed with clay and a wooden center pressed into it. This consists of a semi-cylindrical piece of dry wood having the same diameter as the shaft and about the length of the box. The wooden centers of two or more boxes are now carefully lined and the clay packed tightly around them. When in line the centers are removed, one after another, and the clay cut out crosswise in the middle of each box. The centre is then replaced and the hollow space filled by pouring in babbitt (in the middle of each box) is placed the shaft, which is now accurately in line. Finally the space left is filled with babbitt. In this way the shaft can be quickly and accurately lined, the bearings will be absolutely true and the lining from $\frac{1}{2}$ to $\frac{5}{8}$ inches thicker than the ordinary $\frac{1}{4}$ -inch lining, consequently the shaft itself will last longer.

After the millwright comes the machinist. The Homestake Company having a large shop, all repairs are made there. At the Caledonia mill the foreman is also a machinist, and any extensive repairs are made by the Homestake Company.

As the mills are driven by steam, each one has two engine-men, who are responsible for their firemen. To guard against fire or any other accident, there is generally a night watchman for every mill. These men are directly responsible to the foreman.

The man who has immediate charge of the running of the mill is the head amalgamator. He also stands directly under the foreman, and is responsible for his assistants, the amalgamators, crushermen, oilers, feeders and day-laborers, if there are any. As, in addition to running the mill, he has charge of the collecting and safe-keeping of the amalgam, he must be thoroughly trustworthy as well as capable.

The amalgamators feed quicksilver, regulate the water-supply, set tappets, renew shoes, dies, screens and chuck-blocks, and look after the running of the battery in general. Quicksilver is fed by hand every half-hour with a little wooden spoon, similar to a mustard spoon. The quantity required in twenty-four hours ranges from $\frac{1}{4}$ to $\frac{1}{2}$ lb. for every battery, according to the character of the ore, which varies a good deal. The correct amount is found out by the "feel" of the amalgam collected on the apron-plates. If this be hard and crumbly, there is danger of amalgam being carried off by the pulp, and more quicksilver is added. On the other hand, if too much quicksilver is fed into the mortar, the plates become too soft and slippery, less amalgam collects on the inner plates, and there is danger of liquid amalgam rolling off the apron-plates. Two methods of adding quicksilver are in use. At the Home-

stake mills, all the quicksilver required is added in the mortar, and the amalgam obtained is of medium hardness. At the Caledonia mill it is the aim, by adding only part of the quicksilver in the mortar, to make the amalgam on the inside plates as hard as may be, and to add the rest to the apron-plates, keeping these somewhat softer than those of the Homestake mills. Each management is satisfied with its own way of feeding the quicksilver, and it would be difficult to decide in favor of either method. Perhaps the fact that the Caledonia ore has, on the whole, coarser gold than the Homestake ore, may explain this difference in feeding.

The entire loss in quicksilver incurred by the Homestake management per year per stamp is 5.27 pounds, or, according to the tons of ore milled by the Homestake and Golden Star mills, 0.0044 pounds per ton of rock crushed. The entire loss incurred by the Caledonia mill is 7 pounds per year per stamp, or 0.0011 pounds per ton of rock crushed. Of course, with the hard and strongly-mineralized rock the Caledonia mill has to crush, more quicksilver will be floured per stamp than with the Homestake rock; and on account of the smaller quantity of rock crushed per stamp, less quicksilver is consumed per ton.

The amount of water required will vary according to the specific gravity of the rock, the percentage of sulphurets and the incline of the apron-plates. An excess of water will make the pulp in the mortar too thin (thus preventing an intimate contact of gold and quicksilver), will assist coarse crushing and will hinder the settling of amalgam on the apron-plates. Too little water will assist amalgamation, but will hinder pulp from passing the screens and will not carry that which has passed through them. As a rule it is better to use too little water than an excess. The right amount will just carry the pulp evenly over the apron-plates. The Homestake mills use in twenty-four hours 1 inch of water per battery, the Caledonia mill $1\frac{1}{4}$ inches.

The setting of tappets is necessary that the stamps may always have the same height of drop, whether the shoes and dies are new or somewhat worn down. To accomplish this, the stamps are hung up, the mortar opened, the stamps then lifted up by means of an iron bar, used as a lever, and a block of wood, 1 inch higher than the desired drop, placed between shoe and die. The tappet is then loosened, allowed to fall on to the prop and again keyed fast. As the prop and the block of wood, placed between shoe and die, are both 1 inch higher than the required drop, on removing the blocks, the stamps will all have the desired uniform height of drop, while the different levels at which the tappets are keyed to the stem, will indicate how much the shoe and die are worn down.

The crusher-men, in addition to looking after the grizzlies, breaking the coarse rock and feeding the crushers, have to watch for any pieces of wood and iron found amongst the ore, take it out and throw it aside. This is the only way in which the amount of chips of wood entering the mortar can be reduced to a minimum. All small pieces of wood that pass through the grizzlies are finally found in the mortar, where they are periodically removed by the amalgamators, if not previously taken out by the ore-feeders, when the ore passes from the trough of the automatic feeder into the mortar.

The oilers have to keep all wearing iron parts of the mill lubricated and have to be especially careful not to use any excess of grease at parts where it might drop into the mortar or upon the apron-plates.

The feeders attend exclusively to the regular and uniform feeding of the ore. The principle followed is to "low." The height of ore between shoe and die should never be more than 1 inch and as much less as is possible without the stamp beginning to pound, or, as Mr. Adams* expresses it, "let iron almost wear on iron."

One or two day-laborers are generally found around a large mill, because there is apt to be constant need of extra work which does not fall within the province of the regular hands.

The shafts in the mills are changed monthly. Table V. shows the amount and kind of labor in mills of 60, 80, 100 and 120 stamps.

From the foregoing table it will be seen that the Caledonia mill employs fewer men than any of the other three mills. In comparing the 80 and 120 stamp mills of the Homestake Company, located next to each other and working on the same ore, we see that only three more men are required in the latter than in the former, although the product is half as much again. From this it can be seen that a large number of stamps is very profitable, as greatly increasing production without necessitating commensurate outlay of labor.

Daily Collecting of Amalgam and Dressing of Platss.—The amalgam which has collected on the apron-plates during the previous twenty-four hours is removed every morning when the day-shift begins. At the Homestake mills the head-amalgamator, at the Caledonia the day-amalgamator, each with an assistant, has charge of the operation. Every amalgamator has his own way of managing the details of this work, although the general outline is always the same. The method of the Golden Star mill will serve for illustration.

When the plates are to be cleaned, the water supply of the one battery is shut off, the stamps are hung up and the splash-board removed and washed at the head of the apron plate with water through a lose. It is then placed at the lower end of the plate and the hose is turned on to the screen and apron to remove all the sands that have collected there. The plate, if normal, is now clear and bright, except for occasional spots, so-called blisters, resulting from iron and copper salts. These are removed with a scraper (a blunt, double-edged chisel). Then the two men loosen the amalgam with heavy whisk-brushes, beginning at the top and working downward. When this is done the amalgam is swept in the opposite direction and collected at the head of the apron. There it is brushed into the amalgam-scoop with a rubber scraper (a small, sharp-edged piece of belting) and emptied into a small iron receiver. After this the plates are brightened by brushing them with a whisk-broom, using tailings brightened with a dilute solution of potassium cyanide, the men working from the head of the plate downward. If necessary a little quicksilver is sprinkled on the plate from a bottle over the neck of which a piece of canvas is securely tied. After being brightened, the plates are smoothed with soft paint brushes passed transversely over them, beginning at the bottom. This finishes the operation, which requires four hours for the twenty-four plates.

The amalgam obtained is contaminated with impurities. To remove these it is placed in a Wedgwood mortar and diluted with quicksilver. The amalgamator then adds water and works the amalgam to bring all impurities to the surface. These are in part washed off (the sands) with a hose, in part removed with a sponge or wet cloth (the base-metal amalgam) until the amalgam is perfectly bright. It is then passed through a small strainer and the residual paste

amalgam is transferred to a piece of linen, where the excess of quicksilver is pressed out by wringing. The ball of hard amalgam obtained is locked up in a safe and kept until the next clean-up. All the sands are returned to the battery; the waters go to waste, and the quicksilver goes back to the main stock.

The Clean-up.—Twice a month the gold amalgam adhering to the inner plates is removed, when the necessary repairs in the mill are also made. At the Caledonia mill the operations are the same at the first and fifteenth of the month and similar to those of the first of the month at the Homestake mills. At the latter the clean-up in the middle of the month differs from that at the beginning. At the first of the month the entire mortar is emptied, and the shoes and dies are changed, if necessary.

TABLE V.—Labor and Wages.

CLASS.	Caledonia.* 60 stamps.				Homestake. 80 stamps.				Father de Smet 100 stamps.				Golden Star. 120 stamps.			
	Number	Length of	Wages per	shift.	Number	Length of	Wages per	shift.	Number	Length of	Wages per	shift.	Number	Length of	Wages per	shift.
	employed	shift.	shift.		employed	shift.	shift.		employed	shift.	shift.		employed	shift.	shift.	
Foreman.....	1	12	\$6 50	4 50	1	10	\$5 00	4 25	1	10	\$5 00	4 25	1	10	\$6 50	4 25
Millwright.....	1	12	4 50	3 50	1	10	3 50	3 50	1	10	3 50	3 50	1	10	3 50	3 50
Pipe-fitter.....	2	12	3 50	3 00	2	12	3 50	3 00	2	12	3 50	3 00	2	12	3 50	3 00
Engineer.....	2	12	3 25	3 00	2	12	3 00	3 00	2	12	3 00	3 00	2	12	3 00	3 00
Firemen.....	2	12	3 00	3 00	2	12	3 00	3 00	2	12	3 00	3 00	2	12	3 00	3 00
Watchman.....	1	12	3 00	3 00	1	12	3 00	3 00	1	12	3 00	3 00	1	12	3 00	3 00
Head Amalgamator.....	2	12	3 75	3 50	4	12	3 50	3 50	4	12	3 50	3 50	4	12	3 50	3 50
Amalgamators.....	1	10	3 00	3 00	5	12	3 00	3 00	6	10	3 00	3 00	6	12	3 00	3 00
Crushermen.....	2	12	3 25	3 00	2	12	3 00	3 00	2	12	3 00	3 00	2	12	3 00	3 00
Oilers.....	1	10	2 50	2 50	2	12	2 50	2 50	1	10	2 50	2 50	4	12	2 50	2 50
Feeders.....	1	10	2 50	2 50	2	12	2 50	2 50	1	10	2 50	2 50	4	12	2 50	2 50
Day laborers.....	12				20				25				23			
Total number.....																

* With the 20 additional stamps the Caledonia mill will require only one extra man, a carman, at \$2.50 per shift, to transport the ore. A chute from the main ore bin to the bin of these two new stamps would not have enough fall for the ore to be discharged automatically.

At the Golden Star mill the clean-up at the first of the month is carried on in the following way: It begins at seven in the morning. The feeding of the battery is stopped a quarter of an hour beforehand. The stamps are made to drop slowly, so that at seven o'clock no more ore may be found in the mortar above the screen-frame. The splash-boards are removed, the stamps are hung up, the water is shut off and the engine is stopped. The mortars on one side of the mill are then opened by removing the curtains, screens and chuck-blocks. The curtains and screens are first roughly washed by playing a hose over them. They are put aside to be more carefully cleaned later on. The six chuck-blocks from the batteries facing that side of the mill which is being cleaned up are placed

on two apron-plates, at each of which are four men to remove the amalgam under the supervision of the head amalgamator. This is done by scraping the plates with a chisel, when the hard amalgam drops off on the apron-plate beneath. As much amalgam is removed as is possible without exposing the copper. Then quicksilver is sprinkled on the plate, to dilute the hard amalgam somewhat. This is then divided evenly over the plate and brightened by scouring with a whisk-broom and tailings, and finally smoothed with a soft paint brush. The amalgam that has dropped on the apron-plate from the three chuck-blocks is collected at the head and put under lock and key by the head amalgamator. Thus the chuck-blocks of the entire mill are scraped and cleaned in four sets of six each. In the meantime another set of men scrape and wash the rim and flanges of the mortar and collect the amalgam. They also remove the plate amalgam which has settled during the past twenty-four hours. This is then also taken in charge by the head amalgamator. The dressing of the plates does not take place as yet. In order to keep them soft, a little quicksilver is sprinkled over them and evenly distributed with the brush. A third set of men begin with the work on the mortar as soon as the amalgam from the apron-plate has been removed. Two small platforms are placed at its head on the wooden frame for the men to stand on. They then remove the water, still remaining in the mortar, and shovel out the sands above the dies into a heap on the apron-plate (as the sands consist simply of coarse ore and do not contain any amalgam, they are returned to the battery after the dies have been put again in place). Before the die can be taken out the stamp has to be raised higher. Formerly block and tackle were used for this purpose. Now a piece of timber is placed crosswise on the rests of the splash-board, serving as a fulcrum for an iron bar with which the stamp is raised. It is kept in this position by placing a 4-inch piece of wood on the prop of the stamp and allowing the tappet to rest on it. The dies are pried up with the iron bar, lifted out and roughly cleaned. Those which are to be exchanged are taken away and piled up to be carefully scraped and washed in due time.

(To be Continued.)

THE BELL TELEPHONE CO. OF CANADA.

ANDREW ROBERTSON, PRESIDENT
C. F. SISE, VICE-PRESIDENT
C. P. SCLATER, SECRETARY-TREASURER

HEAD OFFICE, - MONTREAL.

H. C. BAKER, Manager Ontario Department,
HAMILTON.

This Company will sell its instruments at prices ranging from \$10 to \$25 per set. These instruments are under the protection of the Company's patents, and purchasers are therefore entirely free from risk of litigation.

This Company will arrange to connect places not having telegraphic facilities with the nearest telegraph office, or it will build private lines for firms or individuals, connecting their places of business or residences. It is also prepared to manufacture all kinds of electrical apparatus.

Full particulars can be obtained at the Company's offices as above, or at St. John, N.B., Halifax, N.S., Winnipeg, Man., Victoria, B.C.

ALEX. RANKIN,

20 Toronto Street, Toronto Ont.

Agent for sale of Mines and Mineral Lands

CORRESPONDENCE SOLICITED.

Agents in England and New York.

CHEMICAL APPARATUS!

OF EVERY DESCRIPTION.



Glass, Porcelain, Stoneware, Platinum Crucibles of every sort, Analytical Scales and Weights, Fine Chemicals and Reagents, including Volumetric Solutions. Every requisite for Analysis or Experiment. For Sale by

LYMAN, SONS & CO.,
384 St. Paul St., Montreal.

Illustrated Catalogue mailed on receipt of 10c. or Business Card.

ASBESTOS.**THEO. HAMEL,**

44 Mountain Hill, Quebec,

SOLE ASBESTOS MANUFACTURER in CANADA

Write for prices and catalogue. Use Asbestos and save your money. Applied on boilers and Steam pipes it will prevent them from rusting and will economize 33% on fuel

WHAT IS GOING ON FOR MANY MILES AROUND IT IS UNCOVERED TO THIS EYE, AYE MORE



One of the **FREE** BEST Telescopes in the world. Our facilities are unequalled, and to introduce our superior goods we will send **FREE** to ONE PERSON in each locality, as above. Only those who write to us at once can make sure of the chance. All you have to do in return is to show our goods to those who call—your neighbors and those around you. The beginning of this advertisement shows the small end of the telescope. The following cut gives the appearance of it reduced to



about the fiftieth part of its bulk. It is a grand, double size telescope, as large as it is easy to carry. We will also show you how you can make from \$3 to \$10 a day at least, from the start, without experience. Better write at once. We pay all express charges. Address, 11 HALLETT & CO., Box 8840, PORTLAND, MAINE

SPECIALIST IN MICA

MINER'S AGENT

RICHARD BAKER,

6 & 7 Cross Lane, - London, Eng.

MINERS OF NOVA SCOTIA!

W. & A. MOIR,

MECHANICAL

Engineers and Machinists,

HALIFAX.

Manufacturers of

Mill and Mining Machinery,

Air and Circulating Pumps,

Hand and Power Elevators,

Marine & Stationery Engines

And Brass and Iron Castings of every description.

**BURN, NORRIE & CO.,***Locators of Precious Metals*

— AND —

DEALERS IN MINERAL LANDS,

COBOURG, ONT.

W. D. BURN.

P. O. BOX 198.

DAVID NORRIE.

LEDOUX & COMPANY,

10 CEDAR ST., NEW YORK.

Engineers, Metallurgists & Assayers.

Public Ore Sampling & Storage Works

All the principal buyers of furnace materials in the world purchase and pay cash against our certificates of assay, through New York banks.

By special permission of the Secretary of the Treasury of the United States, cars of ore or copper matte passing through in bond can be opened and sampled at our works.

Consignments received and sold to highest bidder. Send for circular giving full particulars.

Mines examined and sampled. Assays and Analyses of all kinds.



Dr. FRANCIS WYATT.
SPECIALTIES:

Sulphuric Acid, Pyrites,
And PHOSPHATES.
24 PARK PLACE,
NEW YORK.

**MONEY ORDERS.**

MONEY ORDERS may be obtained at any Money Order Office in Canada, payable in the Dominion and Newfoundland; also in the United States, the United Kingdom, France, Germany, Austria, Hungary, Italy, Belgium, Switzerland, Portugal, Sweden, Norway, Denmark, the Netherlands, India, Japan, the Australian Colonies, and other countries and British Colonies generally.

On Money Orders payable within Canada the commission is as follows:

If not exceeding \$4	2c.
Over \$4, not exceeding \$10	5c.
" 10, " " "	20c.
" 20, " " "	40c.
" 40, " " "	60c.
" 60, " " "	80c.
" 80, " " "	100c.

On Money Orders payable abroad the commission is:

If not exceeding \$10	10c.
Over \$10, not exceeding \$20	20c.
" 20, " " "	30c.
" 30, " " "	40c.
" 40, " " "	50c.

For further information see OFFICIAL POSTAL GUIDE.

Post Office Department, Ottawa.
15 November, 1909

FREE. OUR NEW **FREE.**
Worth \$100.00. Best watch in the world. Perfect timekeeper. Warranted heavy, SOLID GOLD hunting cases. Both ladies' and gent's sizes, with works and cases of equal value. ONE PEEL-OFF in each locality can secure one **free**, together with our large and valuable line of Household Samples. These samples, as well as the watch, are **free**. All the work you need do is to show what we send you to those who call—your friends and neighbors and those about you—that always results in valuable trade for us, which holds for years when once started, and thus we are repaid. We pay all express, freight, etc. After you know all, if you would like to go to work for us, you can earn from \$20 to \$60 per week and upwards. Address, **Stinson & Co., Box 812, Portland, Maine.**

ASSAYERS' SUPPLIES,

Chemicals and Chemical Apparatus.

BEST GOODS, LOW PRICES, PROMPT SHIPMENT, CAREFUL PACKING.

RICHARDS & COMPANY,

41 Barclay St., New York.

Agents for BECKERS SONS' Balances and Weights of Precision, of Rotterdam, Holland.

Morgan Crucible Co.

BATTERSEA, ENGLAND,

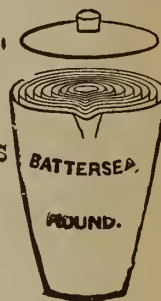
Manufacturers of

Crucibles, Furnaces, Muffles

AND SCORIFIERS

Of superior quality.

LEONARD RICHARDS, Agent,
41 Barclay St., New York.

**SOCIÉTÉ****Canadienne d'Etude Minières**

CAPITAL, - - \$100,000

Assaying, Prospecting and Mining.

HEAD OFFICE, - - - 30 St. FRANCOIS XAVIER ST.
P. O. Box 1625, MONTREAL.
Office in Paris (France) 12 Place Vendome.

DIRECTORATE:

M. SCHWOB, Vice-Consul of France, President.
JOHN S. HALL, Q.C., M.P.P., Vice-President.
C. A. DUGAS, Judge of Sessions } Directors.
C. H. A. GRANT, }
C. DUQUET, Alderman, Quebec, }
G. WERNER, Secretary and Treasurer.
L. DE LA VALLEE POUSSIN, I.C.P. } Consulting Engineers.
JOHN D. FROSSARD, M.E. }
JOHN S. HALL, Q.C., M.P.P., Advocate, Legal Adviser of the E.L.

Established 1831.

EIMER & AMEND

Importers and Manufacturers of Chemicals, Chemical Apparatus and

Assay Goods,

205, 207, 209 and 211 Third Ave,
NEW YORK.

SPECIALTIES:

BALANCES, WEIGHTS,
PLATINUM,

Absolutely pure Chemicals and Acids, Royal Berlin and Meissen Porcelain, Kavalier's Bohemian Glass.



MAP

—OF THE—

PHOSPHATE REGION

—OF—

OTTAWA COUNTY, QUE.

This, the only Map of the Phosphate Region now extant, embraces the Townships of BUCKINGHAM, HULL, PORTLAND (East and West), WAKEFIELD TEMPLETON, DERRY, THE GORE OF TEMPLEYON, VILLENEUVE, &c.

The location of all mines now or lately in active operation are prominently delineated.

As only a few copies of this excellent Map remain unsold, orders should be sent in without delay.

PRICE, TWO DOLLARS.

On sale only at the offices of

THE CANADIAN MINING REVIEW,
OTTAWA.

Boiler For Sale.

AN EIGHTY H.P. TUBULAR STEEL BOILER made by W. C. White, Montreal, 15 ft. x 5 ft. 4 in. —eighty 3½ in. tubes; smoke stack 45 ft. long; guy-lards and guys. Very little used. Equal to new. Price on cars, \$600. Address

P. O. Box 6,
MONTREAL.

THE DOMINION SAFETY BOILER CO.

MANUFACTURERS OF

The 'STIRLING' PATENT WATER TUBE BOILER.

THE SAFEST, MOST ECONOMICAL, COMPACT AND DURABLE BOILER; LARGE MUD DRUM; PERFECT CIRCULATION. BOILERS BUILT FOR ANY REQUIRED PRESSURE. — ALL PARTS READILY ACCESSIBLE FOR THE CLOSEST INSPECTION.

We guarantee dry steam and great economy of fuel. For full particulars and prices apply to the manufacturers,

39 WELLINGTON ST., - MONTREAL

SHIPMAN ENGINES, ACME MODEL. COAL OIL FOR FUEL.



To parties requiring a safe, reliable, durable and economical Steam Launch, from 20x4 to 35x7 with ample power to give satisfactory speed can supply the best on the market and at prices which will defy competition for a like quality of goods. We have a full staff of competent boat and engine builders and guarantee every article to be strictly first class. Hundreds of our engines from 1 to 12 h. p. Marine or Stationary have been in use for years and are acknowledged superior to all others. No smoke, dirt or sparks, no manual or mechanical labor necessary. You have the privacy of your launch for your family. As the water and oil supply is automatic very little attention is required. But a few minutes is necessary to get up 100 lbs. of steam; when you return to the boat house by turning a hand wheel all fire is extinguished. Orders for coming season should be placed at once, as the demand is much in excess of previous years. Write for 1889 circulars giving prices, testimonials, etc. No attention paid to postal cards

JOHN GILLIES & CO., Carleton Place, Ont.



Mines, Elevators, Inclines, &c.

GALVANIZED GUY ROPE. BRIDGE CABLES.
HAWSER ROPES.

WIRE of all kinds. Insulated WIRES

John A. Roebling's Sons Co.

117 & 119 LIBERTY St., NEW YORK.

H. L. SHIPPY Sec'y.

Victor Electric Fuses.

Superior to all others for Exploding any make of Dynamite, High Explosives, or Gelatine Powder. Each Fuse is tested and warranted extra strong and waterproof. Low grades of Dynamite Powder will do ten per cent. more execution if detonated with Victor Electric Fuses.

VICTOR BLASTING MACHINES.

Latest improvements, made in three sizes, easy to operate, strong and durable. No expensive repairs, low in price, will fire any make of Electric Fuses.

MANUFACTURED ONLY BY

JAMES MACBETH & CO.,

128 Maiden Lane, N.Y., U.S.A.

Send for Catalogue.

HARRIS & CAMPBELL

Latest Designs in Drawingroom, Diningroom and Bedroom

FURNITURE

With improved Steam Machinery our facilities for manufacturing Cabinet Goods are complete. Our upholstery Department is well stocked with latest imported patterns.

Corner QUEEN & O'CONNOR Sts
OTTAWA.

D. McEWEN & SON, Machine, Engine & Boiler Works

(Established January, 1868)

Compound and Yacht Engines a Specialty.
Estimates for Steamboats complete.

MINING REPAIRS CONSTANTLY ON HAND.

WORKS AND OFFICE :

54 to 60 Queen Street, Kingston, Ont.

A Warming, Nutritious Beverage,
made in a minute by merely
adding boiling water.



There is NOTHING BETTER on a cold day to WARM YOU AND KEEP YOU WARM than a STEAMING HOT cup of "JOHNSON'S FLUID BEEF." KEPT ON DRAFT at all leading Hotels and Restaurants.

ASK FOR IT.



PROVINCE OF NOVA SCOTIA.

Leases for Mines of Gold, Silver, Coal, Iron, Copper, Lead, Tin

— AND —

PRECIOUS STONES.

Titles given direct from the Crown, Royalties & Rentals moderate

GOLD AND SILVER.

Under the provisions of chap. 7, Revised Statutes, of Mines and Minerals Licenses are issued for prospecting Gold and Silver for a term of six months, which can be extended by renewal for another six months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. Up to five areas the cost is 50 cents per area, for every area in addition 25 cents. Cost of renewal one half the original fees. Leases of any number of areas are granted for a term of 21 years. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents annually for each area contained in the lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at \$19.00 an ounce, and in smelted Gold valued at \$18.00 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province he may stake out the boundaries of the area he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for twelve months are issued, at a cost of twenty dollars, for Minerals other than Gold and Silver, out of which one square mile can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department free of charge, and provision is made for lessees and licensees whereby they can acquire promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties makes the royalties a first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists who have always stated that the Mining Laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are:—Copper, four cents on every unit; Lead, two cents upon every unit; Iron, five cents on every ton; Tin and Precious Stones, five per cent.; Coal, 7½ cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

THE HON. C. E. CHURCH,

Commissioner Public Works and Mines,

HALIFAX,

NOVA SCOTIA.



DEPARTMENT OF Inland Revenue.

AN ACT RESPECTING AGRICULTURAL FERTILIZERS.

The public is hereby notified that the provisions of the Act respecting AGRICULTURAL FERTILIZERS came into force on the 1st of January, 1886 and that all Fertilizers sold thereafter require to be sold subject to the conditions and restrictions therein contained—the main features of which are as follows:

The expression "fertilizer" means and includes all fertilizers which are sold at more than TEN DOLLARS per ton, and which contains ammonia, or its equivalent of nitrogen, or phosphoric acid.

Every manufacturer or importer of fertilizers for sale, shall, in the course of the month of January in each year, and before offering the same fertilizer for sale, transmit to the Minister of Inland Revenue, carriage paid, a sealed glass jar, containing at least two pounds of the fertilizer manufactured or imported by him, with the certificate of analysis of the same, together with an affidavit setting forth that each jar contains a fair average sample of the fertilizer manufactured or imported by him; and such sample shall be preserved by the

Minister of Inland Revenue for the purpose of comparison with any sample of fertilizer which is obtained in the course of the twelve months then next ensuing from such manufacturer or importer, or collected under the provisions of the Adulteration Act, or is transmitted to the chief analyst for analysis.

If the fertilizer is put up in packages, every such package intended for sale or distribution within Canada shall have the manufacturer's certificate of analysis placed upon or securely attached to each package by the manufacturer; if the fertilizer is in bags, it shall be distinctly stamped or printed upon each bag; if it is in barrels, it shall be either branded, stamped or printed upon the head of each barrel or distinctly printed upon good paper and securely pasted upon the head of each barrel, or upon a tag securely attached to the head of each barrel; if it is in bulk, the manufacturer's certificate shall be produced and a copy given to each purchaser.

No fertilizer shall be sold or offered or exposed for sale unless a certificate of analysis and sample of the same shall have been transmitted to the Minister of Inland Revenue and the provisions of the foregoing sub-section have been complied with.

Every person who sells or offers or exposes for sale any fertilizer, in respect of which the provisions of this Act have not been complied with—or who permits a certificate of analysis to be attached to any package, bag or barrel of such fertilizer, or to be produced to the inspectors to accompany the bill of inspection of such inspector stating that the fertilizer contains a larger percentage of the constituents mentioned in sub-section No. 11 of the Act than is contained therein—or who sells, offers or exposes for sale any fertilizer purporting to have been inspected, and which does not contain the percentage of constituents mentioned in the next preceding section—or who sells or offers or exposes for sale any fertilizer which does not contain the per-

centage of constituents mentioned in the manufacturer's certificate accompanying the same, shall be liable in each case to a penalty not exceeding fifty dollars for the first offence, and for each subsequent offence to a penalty not exceeding one hundred dollars. Provided always that deficiency of one per centum of the ammonia, or its equivalent of nitrogen, or of the phosphoric acid, claimed to be contained shall not be considered as evidence of fraudulent intent.

The Act passed in the forty-seventh year of Her Majesty's reign, chaptered thirty-seven and entitled, "*An Act to prevent fraud in the manufacture and sale of agricultural fertilizers*," is by this Act repealed, except in regard to any offence committed against it or any prosecution or other act commenced and not concluded or completed, and any payment of money due in respect of any provision thereof.

A copy of the Act may be obtained upon application to the Department of Inland Revenue, as well as a copy of a Bulletin which it is proposed to issue in April, 1888, concerning the fertilizers

E. MIALL,
Commissioner.

January, 1889.



NOTICE

Is hereby given that all communications in respect to matters affecting the Department of Indian Affairs should be addressed to the Honorable E. Dewdney as Superintendent General of Indian Affairs, and not as Minister of the Interior, or to the undersigned. All Officers of the Department should address their official letters to the undersigned.

L. VANKOUGHNET,
Deputy Superintendent-General
of Indian Affairs.

Department of Indian Affairs,
Ottawa, 17th May, 1889.



Intercolonial Railway OF CANADA.

The direct route between the West and all points on the Lower St. Lawrence and Baie des Chaleurs, Province of Quebec; also for New Brunswick, Nova Scotia, Prince Edward and Cape Breton Islands, Newfoundland and St. Pierre.

EXPRESS TRAINS leave Montreal 11 H. 15 A.M. daily (Sunday excepted) and run through without change between these points in 30 hours. The Through Express Train cars of the Intercolonial Railway are brilliantly lighted by electricity and heated by steam from the locomotive, thus greatly increasing the comfort and safety of travellers.

New and Elegant Buffet Sleeping and Day Cars are run on all through Express Trains.

CANADIAN EUROPEAN MAIL AND PASSENGER ROUTE.

Passengers for Great Britain or the Continent by leaving Montreal on Friday morning will join Outward Mail Steamer at Halifax the same evening.

The attention of shippers is directed to the superior facilities offered by this route for the transport of flour and general merchandise intended for the Eastern Provinces and Newfoundland; also for shipments of grain and produce intended for the European market.

Tickets may be obtained and all information about the route, also Freight and Passenger rates, on application to

G. W. ROBINSON,
Eastern Freight and Passenger Agent,
136½ St. James St., MONTREAL.

E. KING,
Ticket Agent,
27 Sparks Street,
OTTAWA.

D. POTTINGER,
Chief Superintendent.

Railway Offices, Moncton, N.B.
14th November, 1889.

The Polson Iron Works Co'y TORONTO, ONT.

Manufacturers of the Celebrated "Brown Automatic Engine."

GENERAL DEALERS IN

MINING MACHINERY.

SPECIAL AGENTS FOR

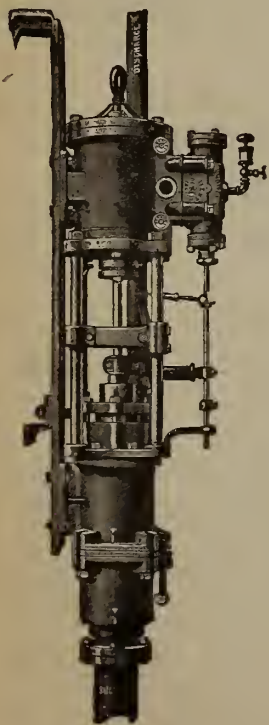
Knowles' Steam Pumps,

B. T. Sturtevant's Blowers and Fans,

Burleigh Rock Drills.

Hoisting Engines and Boilers, Quartz Mills, Diamond Prospecting Drills, Rock Breakers.

Office and Works, Esplanade E.; Warehouse, 38 Yonge St., - - - TORONTO.



THE DOMINION WIRE ROPE CO.

MANUFACTURERS OF



Works at LACHINE.

**FOR HOISTING, MINING, TRANSMISSION OF POWER, TOWING
SHIP RIGGINGS, GUYS, ETC.,**

ALSO

Lang's Patent Wire Rope for Transmission and Colliery Purposes.
JAMES COOPER, Agent, Montreal.

RUSSELL & CO.

PROVINCIAL AND DOMINION

LAND SURVEYORS,
CIVIL AND MINING ENGINEERS,
PORT ARTHUR, ONTARIO.

Mining Properties Surveyed, Reported on and Dealt in

Latest and Most Complete Plans of Thunder Bay
Mining District Always on Hand.

A. L. RUSSELL, A. H. MACDOUGLL, W. W. RUSSELL
P. L. S., D. L. S. P. L. S., D. L. S. M.E.A. MCAN. SOC. C.E.



Mining Regulations

TO GOVERN THE DISPOSAL OF

Mineral Lands other than Coal Lands, 1886.

THESE REGULATIONS shall be applicable to all Dominion Lands containing gold, silver, cinnabar, lead, tin, copper, petroleum, iron or other mineral deposits of economic value, with the exception of coal.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein either by surface or subterranean prospecting for mineral deposits, with a view to obtaining under the Regulations a mining location for the same but no mining location or mining claim shall be granted until the discovery of the vein, lode or deposit of mineral or metal within the limits of the location or claim.

QUARTZ MINING

A location for mining, except for iron on veins, lodes or ledges of quartz or other rock in place shall not exceed forty acres in area. Its length shall not be more than three times its breadth and its surface boundary shall be four straight lines, the opposite sides of which shall be parallel, except where prior locations would prevent, in which case it may be of such a shape as may be approved of by the Superintendent of Mining.

Any person having discovered a mineral deposit may obtain a mining location therefor, in the manner set forth in the Regulations which provides for the character of the survey and the marks necessary to designate the location on the ground.

When the location has been marked conformably to the requirements of the Regulations, the claimant shall within sixty days thereafter, file with the local agent in the Dominion Land Office for the district in which the location is situated, a declaration or oath setting forth the circumstances of his discovery, and describing, as nearly as may be, the locality and dimensions of the claim marked out by him as aforesaid; and shall, along with such declaration, pay to the said agent an entry fee of FIVE DOLLARS. The agent's receipt for such fee will be the claimant's authority to enter into possession of the location applied for.

At any time before the expiration of FIVE years from the date of his obtaining the agent's receipt it shall be open to the claimant to purchase the location on filing with the local agent proof that he has expended not less than FIVE HUNDRED DOLLARS in actual mining operations on the same; but the claimant is required, before the expiration of each of the five years, to prove that he has performed not less than ONE HUNDRED DOLLARS' worth of labor during the year in the actual development of his claim, and at the same time obtain a renewal of his location receipt, for which he is required to pay a fee of FIVE DOLLARS.

The price to be paid for a mining location shall be at the rate of FIVE DOLLARS PER ACRE, cash, and the sum of FIFTY DOLLARS extra for the survey of the same.

No more than one mining location shall be granted to any individual claimant upon the same lode or vein.

IRON.

The Minister of the Interior may grant a location for the mining of iron, not exceeding 160 acres in area which shall be bounded by north and south and east and west lines astronomically, and its breadth shall equal its length. Provided that should any person making an application purporting to be for the purpose of

mining iron thus obtain, whether in good faith or fraudulently, possession of a valuable mineral deposit other than iron, his right in such deposit shall be restricted to the area prescribed by the Regulations for other minerals, and the rest of the location shall revert to the Crown for such disposition as the Minister may direct.

The regulations also provide for the manner in which land may be acquired for milling purposes, reduction works or other works incidental to mining operations.

Locations taken up prior to this date may, until the 1st of August, 1886, be re-marked and re-entered in conformity with the Regulations without payment of new fees in cases where no existing interests would thereby be prejudicially affected.

PLACER MINING.

The Regulations laid down in respect to quartz mining shall be applicable to placer mining as far as they relate to entries, entry fees, assignments, marking of localities, agents' receipts, and generally where they can be applied.

The nature and size of placer mining claims are provided for in the Regulations, including bar, dry, bench creek or hill diggings, and the RIGHTS AND DUTIES OF MINERS are fully set forth.

The Regulations apply also to

BED-ROCK FLUMES, DRAINAGE OF MINES AND DITCHES.

The GENERAL PROVISIONS of the Regulations include the interpretation of expressions used therein; how disputes shall be heard and adjudicated upon; under what circumstances miners shall be entitled to absent themselves from their locations or diggings, etc., etc.

THE SCHEDULE OF MINING REGULATIONS

Contains the forms to be observed in the drawing up of all documents such as:— "Application and affidavit of discoverer of quartz mine." "Receipt for fee paid by applicant for mining location." "Receipt for fee on extension of time for purchase of a mining location." "Patent of a mining location." "Certificate of the assignment of a mining location." "Application for grant for placer mining and affidavit of applicant." "Grant for placer mining." "Certificate of the assignment of a placer mining claim." "Grant to a bed rock flume company." "Grant for drainage." "Grant of right to divert water and construct ditches."

Since the publication, in 1884, of the Mining Regulations to govern the disposal of Dominion Mineral Lands the same have been carefully and thoroughly revised with a view to ensure ample protection to the public interests, and at the same time to encourage the prospector and miner in order that the mineral resources may be made valuable by development.

COPIES OF THE REGULATIONS MAY BE OBTAINED UPON APPLICATION TO THE DEPARTMENT OF THE INTERIOR

A. M. BURGESS,

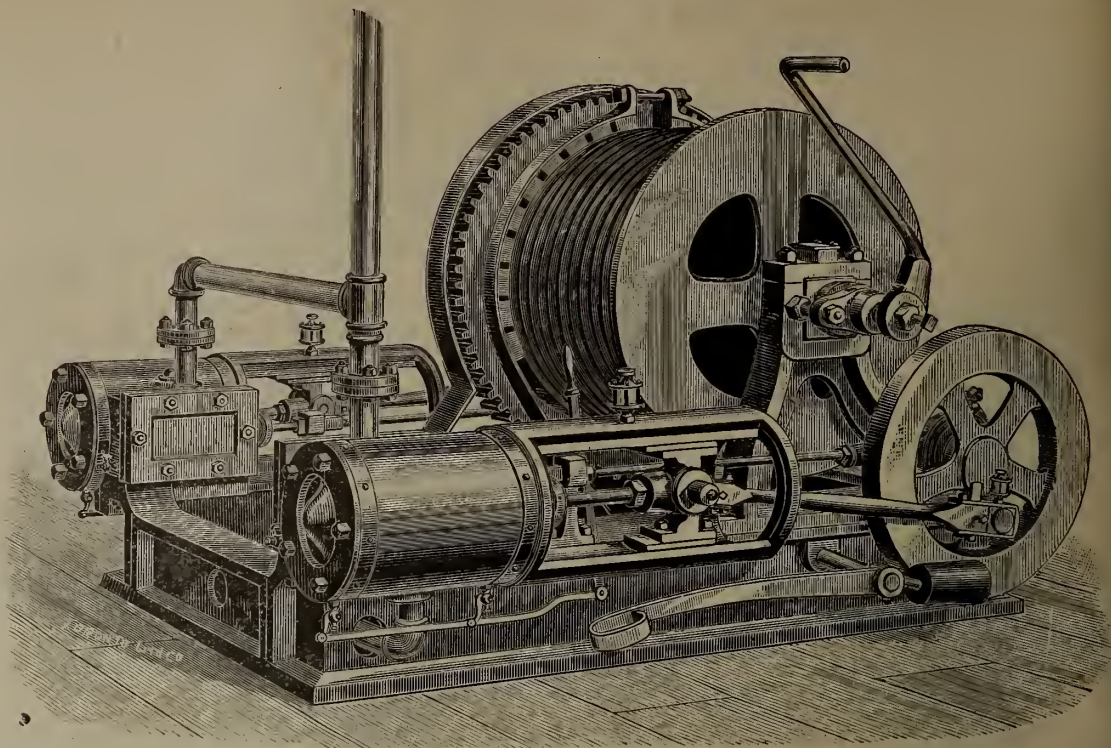
Deputy Minister of the Interior

JOHN DOTY ENGINE CO.

Toronto, Ont.

MANUFACTURERS OF

Mining & General
Machinery.



HOISTING ENGINES

—: FOR :—

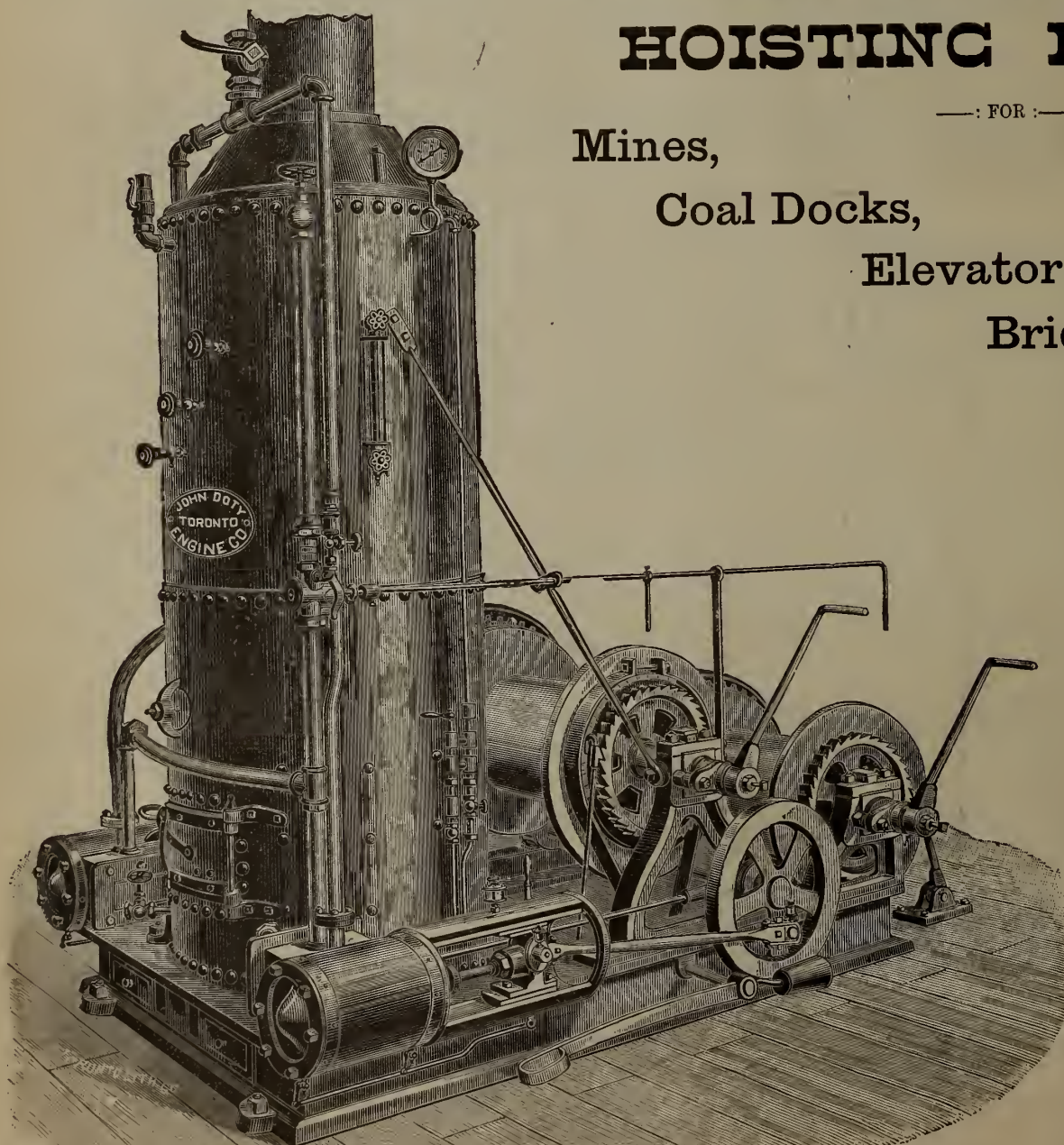
Mines,

Coal Docks,

Elevators,

Bridge Builders,

Contractors, &c.



CORLISS ENGINES

Tug & Steam Yacht Engines,
Mill Engines.

Shafting & Mill
Gearing.

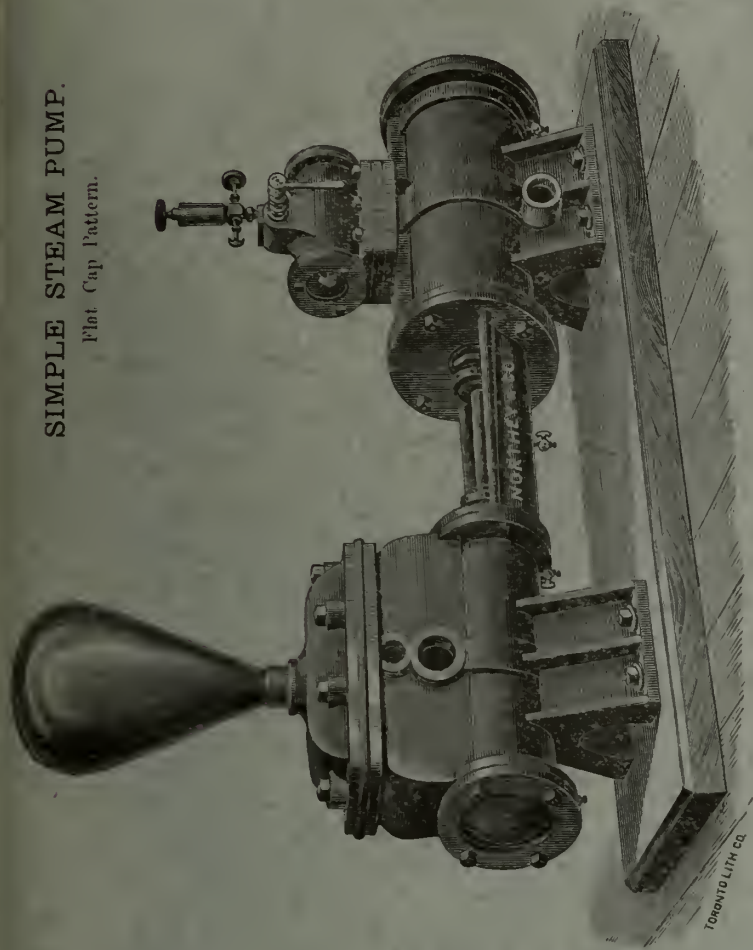
All Descriptions of Boiler
and Tank Work.

Send for Estimates and
Catalogues.

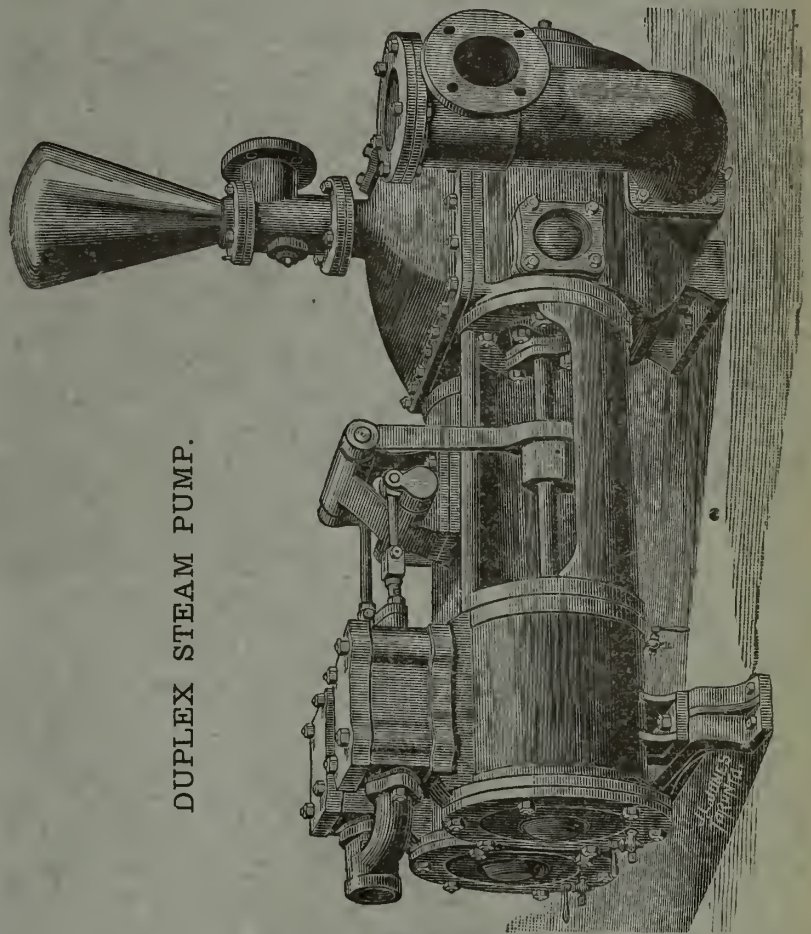
Northey & Co's Steam Pump Works, TORONTO, ONT.

SIMPLE STEAM PUMP.

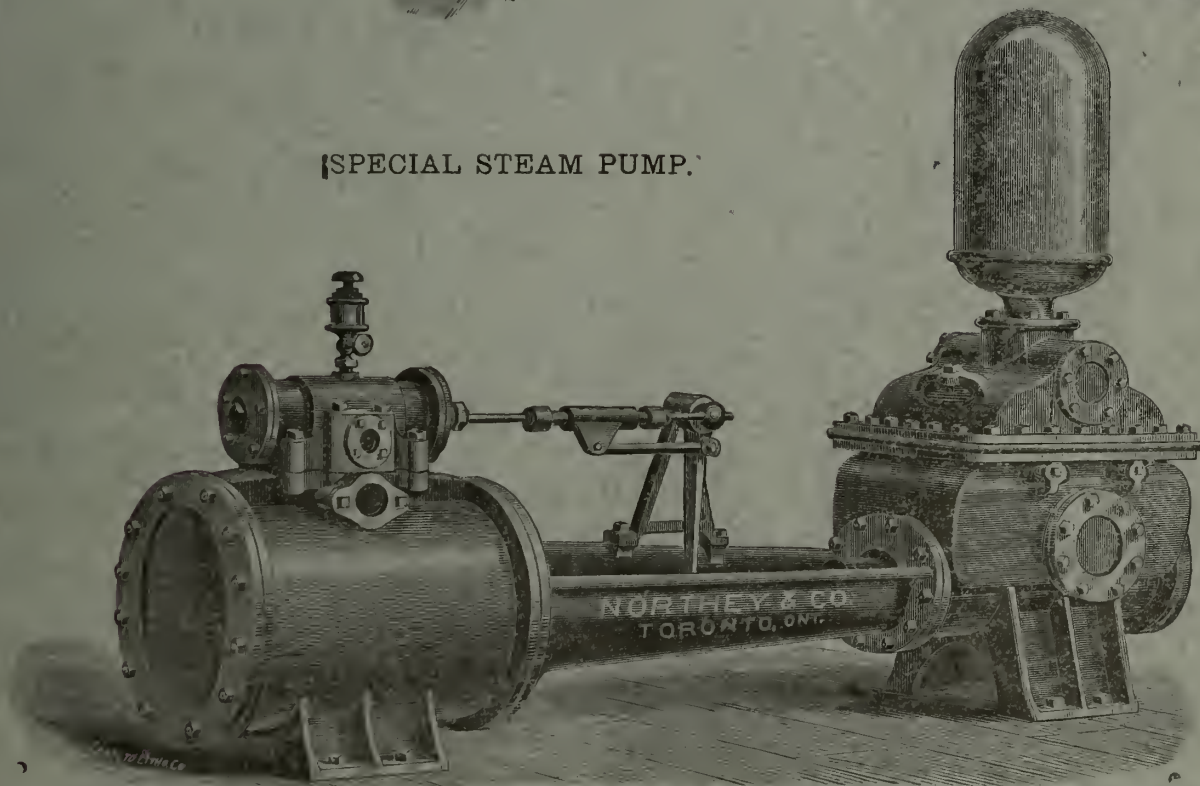
Flat Cap Pattern.



DUPLEX STEAM PUMP.

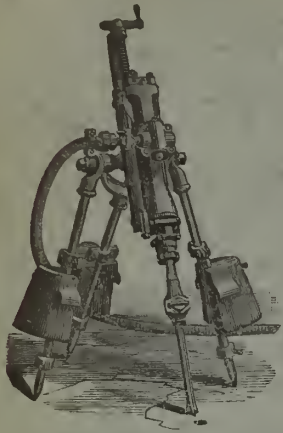


SPECIAL STEAM PUMP.



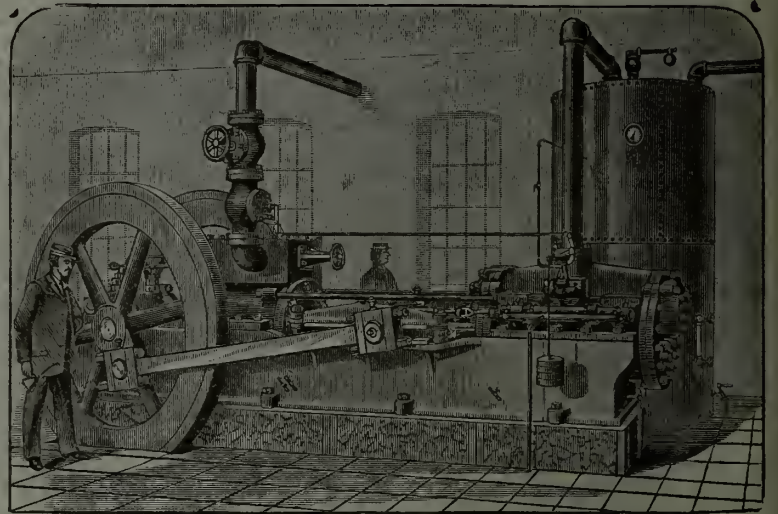
Steam Pumps of the best and latest designs for mining purposes, Boiler Feeding, Fire Protection, and General Water Supply, etc.

NORTHEY & CO.,
Mechanical  Hydraulic Engineers,    Toronto, Ont.
WORKS—COR. FRONT AND PARLIAMENT STS.

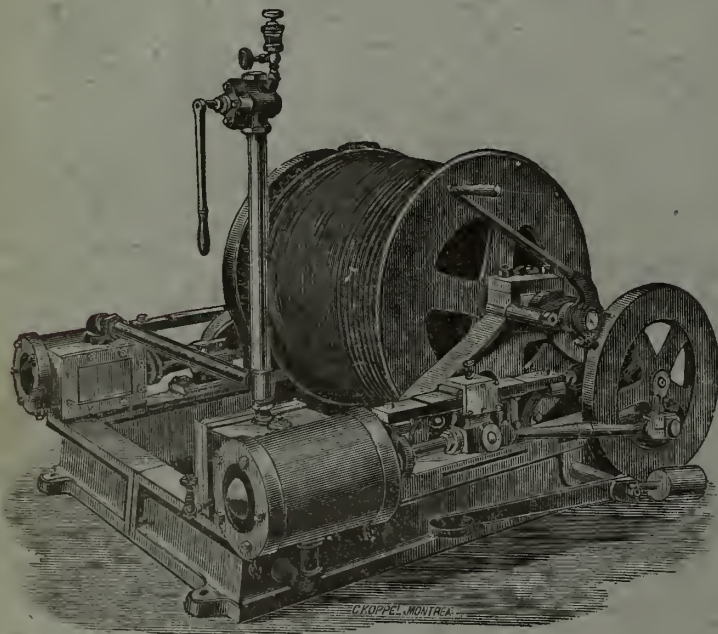


INGERSOLL
ROCK DRILL COMP'Y
OF CANADA
MANUFACTURERS OF

Rock Drills,
Air Compressors,
Steam & Horse Power Hoists,
BOILERS,
GENERAL MINING
Quarrying Machinery
Contractors' Plant.



— ALSO —



Drill Steel, Wire Rope,
Derrick Castings,
Steam & Air Hose & Couplings,
Iron Piping, Fittings,
ALL KINDS OF SUPPLIES
— FOR —
Miners & Contractors' Work.

For Estimates, Catalogues and information address

Ingersoll Rock Drill Co. of Canada

204 St. James St., or P.O. Box 1942, Montreal.

MINING REVIEW

Canadian

Established 1882

THE OFFICIAL ORGAN OF THE GOLD MINERS' ASSOCIATION OF NOVA SCOTIA, AND THE REPRESENTATIVE EXPONENT OF THE CANADIAN MINERAL AND MINING INDUSTRIES.

ESTABLISHED 1882.

INDEX TO VOLUME IX.

1890.

CONTENTS.

EDITORIAL.

	PAGE.
Asbestos Industry, the Canadian	14
Accidents, instructions on immediate remedies in cases of	60
Arbitration	109
American Institute of Mining Engineers	122
Another bluff	151
British investments in 1889	2
British Columbia, royalties on railway lands in	59
Blunder, a curious	152
Coal, rumored discovery of, north of Lake Superior	18
Charcoal pig-iron, the cost of	97
Company promoting, evils inherent to a pernicious system of	139
Iron and Steel Institute, the	121, 139
Lawson, Dr. A. C.	44
Mining as an investment	1
Mining machinery, the duty on	29, 169
Mineral development, aids to	79
Minerals and politics	80
Mining district, the Cariboo	122
Mining tax, the proposed	151, 167
Mineral production in 1889	152
Nova Scotia, the mining industry of, in 1889	1
Nova Scotia, the geological map of	13
Nova Scotia, iron shipbuilding in	30
Nova Scotia, mineral production of in 1889	44
Nova Scotia, mining legislation in	59
Nickel and Copper, Ontario's ores of	167
Nickel and Copper, suggested smelting of, at Ohio	81
Nickel steel, future of	31
Ontario, economic geology of	18
Ontario mining laws, proposed changes in	29
Ontario, natural gas in	30
Ontario, report of the Royal Commission on the mineral resources of	79
Ontario, Report on the mining laws of	79
Ontario Mining Operations Act, the	93
Ontario, our iron interests in	94
Ontario, cement in	110
Phosphates, Florida	13, 109
Phosphate Corporation, limited, the	96, 123
Phosphate mining, systems of	121
Phosphate season, the	123
Phosphate district, a new	123
Phosphate season of 1890, the	168
Pundits, sublime gathering of the	123
Quebec mines, misrepresentation of the output of	16
Quebec, imports of coal by water for 1888 and 1889	17
Quebec, gold fields in	41
Quebec, a mining association for	170
Reminder, a wholesome	169
Superphosphate company, a new	42
Subscribers, special notice to	93
Strike, the Springhill	93
Strikes, suicidal	110
Strikes, the Springhill and Wellington	121
Sudbury mineral lands withdrawn from sale	169
Toronto fire, a lesson from the	17
Tariff, an absurdity of	109

OUR PORTRAIT GALLERY.

	PAGE.
No. 1. Mr. E. Gilpin, jr., deputy commissioner and inspector of Nova Scotia mines	43
No. 2. Mr. H. S. Poole, general manager of the Acadia Coal Co., limited, Stellarton, N.S.	64
No. 3. The late Mr. W. Plummer, mine manager of the West Canada Mining Company	82
No. 4. Mr. A. Dick, Nanaimo, B.C., inspector of mines in British Columbia	97
No. 5. Mr. J. Bowron, gold commissioner for the Cariboo district, B.C.	124
No. 6. Capt. T. H. Tretheway, Port Arthur, Ont.	141
Nos. 7 and 8. Mr. W. Madden and Mr. P. Neville, deputy inspectors of mines for the Province of Nova Scotia	171

LETTERS TO EDITOR.

Accidents while thawing duafin	170
Cobalt in the nickeliferous pyrrhotite of Sudbury	19
Iron ores of Ontario	98
Mint, a Canadian	31
Mines, idle in the State of New York	118
Mining machinery, the duty on	140
Nova Scotia, the geological map of	32
Ontario, a public museum for	31
Phosphate analysis	2, 18, 32, 44
Phosphate district, the new	140
Smelting works at Golden, B.C.	3
Tariff question, the	123

PHOSPHATE NOTES.

General	3, 19, 33, 45, 65, 89, 99, 118, 133, 147
Kingston district	4, 20, 33, 45, 65, 89, 115
Lièvres dist.	4, 20, 33, 45, 65, 89, 101, 114, 131, 148, 162
Perth district	5, 89, 132
Templeton district	4, 19, 33, 45, 65, 89, 101, 114, 131, 162
Wakefield district	5

MINING NOTES.

NOVA SCOTIA.

General	5, 20, 33, 45, 66, 90, 101, 113, 131, 148, 162
Beaver Dam district	20, 45, 66, 131
Caribou do	33, 148
Cape Breton county	6, 46, 113, 131, 147, 162
Central Rawdon district	5, 20, 33, 101, 113, 148, 182
Chester Basin do	131
Colchester county	113
Cumberland do	6, 46, 101, 113, 131, 147, 162, 182
Darr's Hill district	33, 113
Fifteen Mile Stream district	20, 45
Gay's River district	66, 131, 182
Goldenville do	33, 45
Gold River do	90
Killag do	5, 45, 101, 113, 162, 182
Lake Catcha do	34, 182
Lochaber do	45
Malaga do	20, 66, 90, 148, 162, 182
Millisigate do	20
Montague do	113, 131
Mount Uniacke district	5, 33, 113, 131, 162
Oldham district	5, 20, 33, 90, 101, 162

	PAGE.
Pleasant River district	20
Pictou county	5, 46, 100, 113, 131, 147, 162, 182
Renfrew district	5, 66, 101, 113, 131, 182
Rawdon do	101
Salmon River do	5, 45, 90
Sherbrooke do	66
Stormont do	5, 33, 45, 66, 101, 131
Tangier do	131
Waverley do	5, 33, 90, 101, 131, 148, 162, 182
Whiteburn do	5, 20, 45, 148, 162
Wine Harbor do	66, 162
Yarmouth do	66, 182

NEW BRUNSWICK.

General notes	6, 20, 46
---------------------	-----------

QUEBEC.

General	6, 20, 34, 47, 66, 90, 101, 113, 131, 162, 182
Eastern Townships	101, 114, 131, 148
Ottawa Valley	101, 114, 131, 148
Templeton	131

ONTARIO.

General	6, 21, 34, 47, 67, 91, 101, 116, 132, 182
Kingston district	115
Lake of the Woods district	102, 115
Madoc district	34
Perth do	132
Port Arthur	7, 21, 34, 47, 67, 90, 102, 114, 132, 148
Rat Portage district	7, 22, 34, 47, 91
Sudbury do	7, 21, 34, 47, 90, 115

MANITOBA AND N. W. T.

General notes	34, 48, 67, 103, 116, 132
---------------------	---------------------------

BRITISH COLUMBIA.

General	7, 22, 35, 67, 91, 103, 116, 132, 149, 182
Cariboo	49, 132
Cassair	49
Kootenay	49
Vancouver Island	48

MISCELLANEOUS ARTICLES.

Air compressing machinery at collieries	13
Asbestos, Canadian vs Italian	32
Asbestos rivals	138
Asbestos, uses of	177
Asbestos, uses of in the laboratory	150
Aluminum, decreasing cost of	56
Artificial foundations and method of sinking through quicksand	81
Algoma iron region	96
Arbitration in labor disputes in the United States	138
Apatite in Sweden	163
British Columbia collieries in 1889	52
British Columbia coal mines bill	70
Boilers, four large, made in Canada	56
Boilers, proper care of	57
Benefit organization, Belgian collieries system of	63
Benefit institutions, maintenance of, for French miners	70
Blast furnace, peculiar working of a	75
Blake & Knowles steam pump works secured by an English syndicate	106

THE CANADIAN MINING REVIEW.

MISCELLANEOUS ARTICLES.—(Continued.)

	PAGE.
Belgian miners, concerning.....	116
Bee-Hive coke oven, improved.....	117
Brave miner, a.....	143
Brick making in Bagdad.....	163
British returns of colliery labor.....	175
Company floating in London.....	8
Coal fields of Natal.....	18
Colorado's mineral palace.....	63
Canadian Phosphate Co., limited, annual meeting of.....	71
Coal mining by machinery.....	77
Copper mining on Lake Superior, early history of.....	84
Coal production of the United Kingdom, 1889.....	89
Coke bricks for furnace linings.....	103
Copper, improvements in the manufacture of.....	103
Colliery ventilation.....	111
Coal combination.....	118
Capelton Chemical and Fertilizer Works, the.....	126
Colliery winding ropes.....	133
Colliery managers, the duties of and coal mining.....	136
Comparison of electricity and compressed air.....	138
Coal production in Japan.....	138
Coal mining in Natal.....	143
Canadian minerals, annotated list of.....	144, 163, 183
Coke making in Australia.....	162
Canada's mineral wealth.....	170
Coal shaft, a model.....	185
Coal mining machines.....	52
Dry machine for alluvial gold, a.....	63
Dressing works of the St. Joseph Lead Company at Bonne Terre, Missouri.....	127
Egyptian cats, sale of.....	23
Engine room, facilities in the.....	56
"Eiffel" tower for World's Fair at Chicago.....	63
Electric mining application.....	69
Excelsior Copper Co., limited, meeting of.....	72
English colliers at home.....	81
Evvard Coal washer, the.....	112
Electric oil well driller, an.....	150
Electric mining plant, a large.....	172
East Wellington colliery, B. C.....	53
Failure of steel flat cars.....	57
Forth bridge, strength of.....	58
Foundry work, estimating the cost of.....	77
Friction of mine car wheels.....	87
Friction-tests on Susquehanna Coal Company's mine-cars, 1889, summary of.....	87
Gold milling in the Black Hills.....	10
Gold refining at the Australian mints.....	22
Gold Miners' Association of Nova Scotia.....	35
Gold mining and milling in Corea.....	40
Gold mining as an industry.....	50
Gold bricks from Barkerville.....	50
Gold mining in British Guiana.....	63
Gold, the treatment of fine in the sands of Snake River, Idaho.....	134
Gold mining in Australia.....	149
Gold extraction by MacArthur-Forrest process.....	161
Geologists, the training of.....	50
Gas, outburst of in metalliferous mines.....	54
Graphite as a blast furnace lining.....	56
General Mining Association, meeting of.....	63
General Phosphate Corporation.....	103, 137
Good words for Canada.....	171
German Government and the miners.....	138
Hauraki gold mining district (northern section), Auckland, New Zealand.....	173
Hoisting machinery.....	23
Iron ore in British Columbia.....	57
Iron ore in Newfoundland.....	72
Iron bounty, Canadian.....	86
Iron ores, the desulphurization of pyritiferous.....	107, 119
Improved steam dredger for minerals.....	138
Iron and Steel Institute, visit to Canada of.....	142, 152

MISCELLANEOUS ARTICLES.—(Continued.)

	PAGE.
Invention, a remarkable.....	181
Lightning, curious occurrence of in a Scotch colliery.....	22
Loadstone in Sweden.....	57
Life preservers for miners.....	57
Lignite briquettes.....	77
Lievres phosphate mines, a trip to.....	83
Lamp cleaning by machinery.....	112
Lake of the Woods gold district.....	116
Miner machinery, importation of.....	18, 37, 57, 70
Metallurgical progress in 1889.....	19
Mining Claims Act, the.....	41
Mining tax adopted, the.....	183
Mines and minerals, report of the committee on, to the Nova Scotia Legislature.....	68
Mica, new use for.....	77
Miraculous escape, a.....	89
Miner in relation to mineralogy, the.....	98
Mine maps.....	98
Manganese, a new method of preparing.....	100
Mining in the Cariboo district, B. C.....	124
Masonry supports in the Tilly-Foster iron mine.....	126
Magnetites, some Ontario.....	146
Mining under the sea in the north of England.....	185
Minerals of Nova Scotia, the geological relations of the principal.....	26
Nova Scotia gold yield, 1889.....	40
Nova Scotia gold mines, the quarter's yield as per official returns.....	56
Native copper, occurrence of, on Thunder Bay.....	74
Nickel and its uses.....	111
Nickel refining and steel works, proposition to erect, in Ontario.....	158
Nickel, alloys of.....	163
Nickel steel tried in Europe.....	170
Nickel steel, the properties of.....	185
Notes on some coals in Western Canada.....	119
Newfoundland Colonization and Mining Co., limited, annual meeting of.....	142
New Vancouver Coal Mining and Land Co., limited, meeting of.....	172
Nanainio colliery, B. C.....	52
Ores, concentration of low grade.....	35
Ontario, Report of the Commission upon the mineral resources of.....	72
Oil wells, Petrolia.....	78
Ore roaster, the Davis-Colby.....	104
Ottawa County mine owners, meeting of, in Montreal.....	157
Oyster Harbor Coal Co., B. C.....	54
Port Arthur Silver mines, exports from, 1889.....	8
Plumbago, increase in the demand for.....	10
Phosphates, Florida.....	12, 100
Port Arthur mines, prosperity of.....	16
Phosphate Trust, the.....	22, 41
Platform, a movable, for inclined planes in mines.....	35
Pumping engines, duty trials of.....	35
Pump working under heavy pressure in Nova Scotia collieries.....	41
Persia as a field for mine managers and mining engineers.....	57
Pipe line for natural gas, a big.....	106
Port Arthur silver region, the future of.....	119
Peat fuel, Canadian.....	130
Peat beds, the Canadian.....	174
Portland cement for machinery bolts.....	133
Profit sharing by a coal company.....	133
Profit sharing at English iron works.....	140
Phosphate industry, the Canadian.....	158
Platinum, remarkable increase in the value of.....	177
Pneumatic hoisting.....	178
Quebec, the mining industries of eastern.....	23
Quarrying, the invisible cost of.....	76
Quarrying, notes on.....	99
Quicksand, Haase's system of sinking through.....	120
Quebec mines, proposed taxation of.....	156, 183

MISCELLANEOUS ARTICLES.—(Continued.)

	PAGE.
Record of a great steel plant.....	56
Royal mining school of Freiberg.....	76
Railways, the progress of Canadian.....	118
Superphosphate works at Smith's Falls.....	77
Safety cages.....	77
Shaft sinking by the Kind-Chaudron method.....	77
School of mines, Government assistance to.....	78
Steam pumps, hints on selection and management.....	110
Striker's Paradise, a.....	111
Steel production in Great Britain in 1888 and 1889.....	111
Seller's regrets, a.....	116
Silver mining in Montana.....	134
Saarbrücken collieries, ventilation of.....	138
Slate, tests to be applied to.....	140
Steam engines, hints on how to manage.....	149
Sunday opening of the Geological and Natural History Survey Museum.....	174
Steam boiler tests as a means of determining the calorific value of fuels.....	176
Tharsis Sulphur and Copper Co., profits of the.....	63
Tin mill, the first American.....	150
Tumbo Island Coal Mining Co.....	53
Union colliery, Comox B. C.....	53
Unions and strikes.....	143
Underground pumping.....	150
Victoria gold field, production of.....	57
Wire rope fastenings.....	31
Wire ropes.....	44
Wire ropes, treatment of.....	57
Wealth of the United States, increase in.....	120
West Kootenay minerals at Toronto.....	132
Wells Light, the.....	175
Wellington colliery.....	53

NEW COMPANIES.

Anglo-American Mining Co.....	67
Brompton Lake Asbestos Co.....	21
Brunswick Manganese Co.....	6
Canadian Smelting and Refining Co.....	162
Canadian Rand Drill Co.....	65
Crowfoot Coal Co.....	22
Crow's Bar Mining Co.....	103
Dominion Iron and Steel Co.....	111
East Templeton District Phosphate Mining Syndicate.....	4
Frontenac Phosphate Co., limited.....	101
Gravel Bay Mining Co.....	6
General Phosphate Corporation, limited.....	96
Halifax Mining and Prospecting Co.....	131
Kingston Phosphate Mining Co.....	65
Lawson Antimony Mining Co.....	113
McLaurin Phosphate Mining Syndicate.....	4
Montawa Gold Mine Co.....	162
Middle Creek Gold Mining Co.....	103
Northwestern Gold and Silver Mining Co.....	103
Nova Scotia Syndicate.....	42
Nova Scotia Steel and Iron Co.....	90
Napier Mining Co.....	131
North Star Mining Co.....	162
Premier Oil Co.....	116
Revelstoke Mining Co.....	7
Sebastopol Phosphate Syndicate.....	132
Silver Glance Co.....	67
Silver Centre Mining Co.....	101
Standard Asbestos Co. of Ontario.....	148
Standard Oil and Gas Co. of Ontario.....	182
Stanley Gold Mining Co.....	113
Tenny Cape Manganese Co.....	90
Vivian, H. H. Co. of Swansea, Wales.....	47
Windsor Gold Mining Co.....	148

LEGAL.

Burk v. Tunstall.....	106
Prosecution under the B. C. Coal Mines Regulation Act.....	106

The Canadian Mining Review

CONDUCTED BY - - - B. T. A. BELL

OFFICES:
UNION CHAMBERS, 14 Metcalfe St.
OTTAWA.

Vol. IX. JANUARY, 1889. No. 1.

Mining as an Investment.

There is perhaps no better time to call attention to the value of mines as investments than at the beginning of a new year, when men's minds are yet occupied with the profits and losses of the year just closed. In many ways the year 1889 was a notable one for Canada in the way of mineral development. The development of the large copper and nickel mines at Sudbury, and the highly successful campaign of the large blast furnaces there have given evidence of what skill and capital combined can do to make mining a safe and lucrative investment. The increased activity in the Port Arthur silver region, the large shipments from the phosphate country, the increased production of the gold fields of Nova Scotia, together with the many incorporated schemes looking to the development of our large iron deposits have drawn many eyes and turned many minds to the consideration of the value of mines and metallurgical works as a source for profitable investments.

In the United States the past year has been a very prosperous one for the mineral industries. We have taken a list of thirty-one prominent mines in that country, whose shares are openly dealt in upon the market, and therefore whose records are open and available, and the results, summarized are as follows:—

Total share or nominal capital of 31 companies.....	\$158,955,000
Total market value of capital of 31 companies.....	78,111,000
Total dividends paid in 1889 upon above capital.....	9,472,000
Total dividends paid to date by 31 companies.....	88,457,145

These figures show that the actual value of the mines as deduced from the daily quotations in open market was 50% of the nominal capital. Also that the dividends paid last year realized 12% on the market value, or about 6% on the share value. Furthermore that that these thirty-one mining companies had paid in dividends since their inception 113% on their present value, or nearly 60% on their nominal share capital.

Such figures as these are the best answer to the statements so frequently made that "to put money into mines is to gamble." Mining is a legitimate business when it is conducted in the same manner and on the same principle as other legitimate businesses, and its profits often are very much greater.

That mines are but too frequently made to serve the purpose of unsuccessful speculators is unfortunately true, but the victims are to a large extent responsible for being thus deceived, as it is not at all an impossible thing to deter-

mine the actual present value of a mine—a mine has no mystery necessarily. Now a days there is a sufficiency of honest and competent mining experts who can and will give an honest and reliable valuation of any mining property that may be offered to investors, and it is only upon such demonstrated value that an investment should be made; what the promoter thinks likely or possible, or *believes* will be found afterwards, in depth, or in the future, offers a foundation for nothing but gambling.

Were the same principles of ordinary business prudence used in making investments in mines that are used (by the same investors it may be) in making investments in real estate, railroad securities, or bank stocks, there would be fewer failures and a very different moral feeling towards mining and those engaged therein.

To make mining profitable as an investment then (1) the price paid for the property must be proportioned to its actual demonstrated value, as determined by an honest and competent expert; (2) an amount of working capital sufficient to put the property upon a self-sustaining basis must be supplied; (3) the person or persons entrusted with the management must be honest, skilful, and last, but by no means least, economical.

Profits coming from the legitimate working of mines benefit the industry by inducing further investments of capital, but the speculator who sells a prospect for ten or a hundred times its value, is no benefactor.

It is only by making mining profitable to those whose money is invested in the *actual working of the mines* that a healthy and legitimate growth of the mining industry can be attained.

The Mining Industry of Nova Scotia in 1889.

The year 1889 was a very prosperous one for the mining interests of Nova Scotia. The coal iron and gold mines were all active and labor was in demand. The total output of coal for the province was in round numbers, 1,760,000 tons, and the shipments aggregated 1,560,000 tons against 1,576,691 tons in 1888. This decrease of 16,500 tons is but little more than 1% of the sales, and is trifling, and the year shows an advance of nearly 3% over 1887 and 12% over 1886. The decrease of 16,500 tons is principally from Pictou, three mines there (the Drummond, Albion and Vale) aggregating a decrease of 46,000 tons. Cumberland county almost held its own, both Springhill and Chignecto collieries showing an increase, but the Joggins has a large falling off of over 5,000 tons. The increase in Cape Breton is remarkable in two mines, the International and Victoria, the two aggregating an increase of 40,000 tons; all the other Cape Breton collieries, excepting Bridgeport, report decreased sales.

The yield of gold in round numbers was 25,000 ounces, an increase of 2,500 ounces over

1888, and, with the exception of the three years, 1865-6-7, the largest product of any year since discovery. It was confidently expected in July that the year's yield would exceed any year in the history of the province, as the product for the first six months was 13,623 ounces, but the sudden falling off of the yield in the Caribou and North Brookfield districts, coupled with the transfer of the Central Rawdon property in September, make the yield for the second six months less than 12,000 ounces. The new management at Central Rawdon wisely curtailed production until the mine was put in shape to handle the ore more economically. Some of the older districts have fallen off during the year, due probably to the inevitable lean spots which occur in the history of every paying lode, among these are Salmon River, Oxford and Caribou. Rawdon has not been a producer during the year.

There were five districts having a production exceeding 2,000 ounces, viz:—Molega, 2 producing mines, Oldham, 1 mine, Whiteburn, 2 mines, Central Rawdon, 1 mine, Salmon River, 1 mine; and the aggregate of their production will exceed \$250,000, or more than one-half of the total yield.

The outlook for this present year is very bright. Central Rawdon, Molega, Whiteburn, Oxford, and Salmon River will be steady and heavy producers. Sherbrooke and Mt. Uniacke will exceed last year's record, and Chester Basin is expected to be a regular producer. North Brookfield and Oldham will probably show a decrease, and perhaps also Stormont. Montagu is uncertain, but will probably increase its production.

The iron industry received quite an impetus during 1889 through the various schemes which were set on foot to develop the resources of the East River of Pictou. The Nova Scotia Coal, Iron and Railway Co. had a force of miners at work in the latter part of the year developing one of the deposits leased by them, and considerable ore of good quality has been mined.

Another company, called the Nova Scotia Midland Iron and Railway Co. has commenced to build a railroad from its property to New Glasgow, a distance about 18 miles.

The output of the Londonderry mines is not known at date of writing, but the works have been kept busy all the year, and have had a big run on contracts to supply cast iron pipes. The mines are heavily handicapped by the heavy expense entailed in timbering, but it is confidently asserted that the new company and new management will bring up the industry to its proper position.

The re-adjustment of prices for copper, consequent upon the collapse of the French Syndicate, has been steadied, and has brought up the price again to a point at which the Coxheath mines in Cape Breton can probably produce at a profit.

The minor industries of Antimony and Manganese were not in a flourishing condition last year; the sudden and abnormal rise in antimony may however stimulate the owners of the Gore property into reviving the work at their undoubtedly valuable property.

British Investments in 1889.

During last year there were registered in England 2,560 new companies involving a total capital of £222,658,000 sterling. These figures show an increase of 70 new companies, but a decrease in capitalization of £123,061,000 sterling compared with 1888. It would appear, therefore, that the past year has been prolific in small enterprises, due, no doubt, to the rapid conversion of small private concerns into joint stock companies. Of the above companies it is interesting to observe that 370, with a capital of £35,000,000, were mining undertakings.

LETTERS TO THE EDITOR.

Phosphate Analysis.

New Broad Street House, London, Eng.,
20th Dec., 1889.

The Editor,

SIR,—I have read with a considerable amount of interest the letter of my friend Captain Adams which appeared, under the above heading, in your November issue, and none the less so that I had only a short time previously met with the Report of the British Consul for Rochelle, which in part relates to the English trade in fertilizers with France. Naturally looking at the matter from a different point of view, it yet appears in no degree surprising that, under the circumstances, the Consul should arrive at the conclusion that if such measures as those advocated by Captain Adams are not adopted by the manufacturers in England, their continental trade, which is one of immense importance, will be irrevocably lost.

The Consul, after speaking of the immense proportions and growing importance of the trade in fertilizers, states that whilst English manufacturers have hitherto had a practical monopoly of the trade, they are now rapidly losing it, if they have not already lost it; and that this untoward result is brought about solely by the unwillingness evinced by them to take steps for adapting the trade to the requirements of their continental customers. Firms in France, prompt to avail themselves of the opportunity, have already established large factories there, with the view of acquiring the trade for themselves and carrying it on in their own country. The Consul states that the causes of a state of things, so prejudicial to English interests, having been enquired into by him, may thus be shortly stated.

The English manufacturers, he states, have have lost the continental market because they have failed to adapt the trade to suit the local demands. Thus, for instance, they will not sell at a fixed strength, but quote their superphosphate at an uncertain price, say from 5s. to 6s. for an uncertain strength from 10 to 12 degrees. The strength, consequently, has to be tested

after it arrives, to ascertain the number of degrees; the price being then fixed accordingly. By this method of doing business the buyer is compelled at one time to take it at a higher price, and at another at a lower according to the results of the analysis. This the French farmers most strongly object to; they require to buy at a fixed degree so that they may know exactly what they are getting for the money they pay. He further considers it most undesirable that importers should have to manipulate the fertilizers after receiving them, which at present they are obliged to do in order to meet the requirements of their customers, the farmers; on the contrary, he insists upon it, that the fertilizers should always be sold exactly as received from the wholesale houses; because, when the proportions are altered subsequently, a tempting opportunity is given for adulteration, and the natural result follows that the goods dealt in acquire a bad name.

It appears to be universally admitted that a better article than that supplied from England does not exist; consequently, the Consul is of opinion that good business even yet may be done if only the English firms will sell at a moderate price, and study, more than they have at present evinced a willingness to do, the want and expressed wishes of their foreign customers.

Englishmen, as we know, are somewhat unwilling to travel out of old grooves, but in face of so serious a state of things as that disclosed in the Consular report, manufacturers will not be slow to perceive the absolute necessity of changing their system, in order to prevent the foreign trade slipping entirely through their fingers.

In any case it is clear that the time is now ripe for a change; consequently the opportune moment has arrived for the Canadian producers to unite in urging the adoption of their views upon the general body of manufacturers here; and as their views, as set forth by Captain Adams, seem to be based on justice, it is only to be expected that they will be fairly considered by the manufacturers, and as far as possible be given effect to in the alterations of the methods of doing business which seem to be now inevitable.

Yours etc.,

ROBERT H. JONES.

Buckingham, Que.,
13th Jan., 1890.

The Editor,

SIR,—We have perused Mr. Adams' grievances and his suggestions for remedying his unhappy experiences in disposing of his apatite ore, but we are not inclined to admit that the practices of well known brokers and dealers are so corrupt, or chemical analysis so intentionally elastic as a casual reader of these statements might be led to suppose.

We desire here, however, to only refer to the technical operations, the commercial dealings offering no difficulty to any competent man of business.

We presume therefore that the parcel of phosphate to be analysed has been correctly and methodically sampled, so that the sample *really* represents the ore in question; this result is no easy matter to obtain from the average product of our local mines, consisting of lumps and powdered *debris*, which are invariably of different degrees of richness, and when we take into account the rough and ready means employed, we may well marvel at so near an agreement of results as is usually obtained. It may also

surprise some readers to learn that we know of only one mine in this region which possesses any decent mechanical necessities for *reducing* and preparing their samples, and no mine possesses a chemical laboratory by which controlling analyses could be effected, thus rendering invaluable guidance for timely classification, by which subsequent disappointment might be avoided.

Now before comparing the results of analyses obtained by two or more chemists, we must first assure ourselves that the samples sent or subjected to analysis, are absolutely identical and homogeneous, and when this condition has been obtained, another cause of divergence in the analyses may creep in, if it has not been stipulated that the *same method of analyses* be adopted by the respective chemists.

These differences of analytical results have been recognized long ago in various commercial branches, to arise from the different methods of analysis employed on the same sample, and not to be attributable to any inconstancy of chemical reactions or even to faults of manipulation on the part of the operator. The analysis of such valuable manurial products as potash, nitrogen (ammonia) and phosphoric acid have undeniably figured very prominently as a cause of these complaints, until associations and chambers of commerce have led the way to agree upon and impose one particular method of analysis to be applied to these commercial samples. Thus the syndicated mining companies of the Somme phosphate (which is a high grade) have long imposed that the analysis guaranteed by them refer to the result obtained by Maret's method of analysis, both for phosphoric acid and for the contaminating ingredients of oxide of iron and alumina.

As we have strongly deprecated the rough rule-of-thumb systems existing in the mining operations in the Ottawa County, we hope to soon see a change for the better, and with this end in view it may be acceptable to some of your readers to here describe a method of phosphate analysis suitable for our Canadian apatite, and which is at the same time rapid, simple and trustworthy when carried out in accordance with the prescribed details. It is the method much employed in France, and generally known as Maret's method above referred to.

The whole of the sample is rendered sufficiently fine to pass through a sieve of 80 meshes to the linear inch, and then intimately mixed. The solutions of fixed strength are thus prepared:—

1. *Ammonical Citrate Ammonia*.—Dissolve 400 grammes of crystallised citric acid in liquid ammonia, .880 and complete volume to the litre.

Ammonical Solution of Chloride of Magnesium and Chloride of Ammonium.—Dissolve 8 grammes of carbonate of magnesia in *quantum sufficit* of hydrochloric acid; add 120 grammes of chloride of ammonium; render slightly alkaline by liquid ammonia; add excess of ammonia 200 centimetre-cubes, and water to complete volume of one litre; finally allow to stand a few days and filter before use.

3. *Wash-Water*.—Distilled water 800 cent.-cubes, ammonia 200 cent.-cubes, and chloride ammonium 5 grammes.

Analysis.—One gramme of the sample is weighed with a porcelain evaporating basin; 10 cent.-cubes of concentrated hydrochloric acid added, and then set to digest about ten minutes on the water bath; now add 20 cent.-cubes of water and allow to evaporate to perfect dryness. The dried residue is taken up with 30

cent.-cubes of dilute hydrochloric acid (containing $\frac{1}{3}$ part of concentrated acid) digested during ten minutes more on the water bath and subsequently filtered. The filtrate is received in a conical foot glass, the paper filter and porcelain basin being sufficiently washed with distilled water. Now add to the filtered liquid with washings, 50 cent.-cubes of the alkaline citrate of ammonia solution (1); 60 cent.-cubes of strong liquid ammonia (.880); and 10 cent.-cubes of the alkaline chloride of magnesium. The total volume of the liquid for precipitation being about 350 cent.-cubes; it is gently stirred for a few minutes and afterwards allowed to stand for at least twelve hours. The precipitated ammoniac-magnesian phosphate is collected on a filter, employing a feather to detach the adhering deposit in the precipitating glass. The ammoniacal wash water (3) is used for this washing, which should be effected in five rejections, taking the precaution to allow the filter to drain each time before proceeding to a fresh washing. The filter and its contents are allowed to drain, and partially dried is removed to a weighed platinum crucible or capsule and completely dried in the air bath. It is then slowly heated to dark red, and finally to a white heat, or until the calcined pyrophosphate of magnesia becomes absolutely white. After cooling it is weighed, and the known weight of the filter ash deducted, together with the tare of the crucible. This product multiplied by 63.96 gives the percentage of phosphoric acid in the sample, and the result of phosphoric acid multiplied by 2.183 gives the equivalent percentage of "bone phosphate," or tribasic phosphate of lime.

We have thoroughly tested this process ourselves, and find it reliable and expeditious, and we have thought it useful to describe it, because we have never seen it mentioned in any of the ordinary analytical text books.

On a future occasion we will also describe the Maret method of estimating the oxide of iron and alumina in mineral phosphates, which may have an interest for some of our local miners.

I am, etc.,

J. LAINSON-WILLS.

The Smelting Works at Golden, B. C.

CALGARY, 9th Jan., 1890.

The Editor,

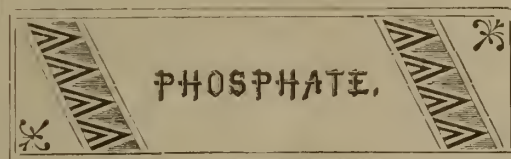
THE CANADIAN MINING REVIEW.

DEAR SIR.—In the December number of your Review, under the above heading, you state that there is some talk of erecting another smelter in Kootenay, so located to suit the mines at Golden and Donald, and that Mr. McCarthy of Calgary was the moving spirit. As I am, no doubt, the person referred to, I take pleasure in giving you the particulars of the report which has reached you, and confirm same. Although considerable has been done by those associated with me, we have not, and do not now wish to make any statements but that which we are confident will be borne out by our future actions, as nothing is more detrimental to the interests of those engaged in mining or in mining enterprises, than spreading reports wholly foundationless, or made with the interest of working up a mining boom in any particular locality. I know of no industry which is more injured than the mining industry by false reports sent out evidently by those who have the sole object in view I have mentioned, and I attribute to this more than any other cause, the want of faith which the public are liable to have in anything connected with mining. What I herein state may be relied on. In the spring of 1888 H. B. Alexander of Alberta, John L. Bowen, James A.

Lougheed and myself formed a partnership for the purpose of erecting smelting works at Field, on the line of the C. P. R. in British Columbia, and purchased two mining locations at Mount Stephen near that place. In May, 1888, we went to Chicago and purchased from Messrs. Fraser & Chalmers a 40 ton smelter, an ore breaker, a pair of rolls, iron for reverberatory furnace, and in fact everything requisite for a complete plant, except engine and boiler which we intended purchasing in Canada; all this plant has been paid for and has been ready for shipment for some months. In August last we engaged S. S. Fowler, M. E. of Chicago, to erect and superintend our works, and for that purpose he came on, but after examining our proposed site at Field, and visiting Golden on the Columbia River, he advised us to locate our works at Golden, 33 miles west of Field, if a proper site could be obtained at that place. The Dominion Government, in order to encourage smelting operations in British Columbia, gave our firm a tract of land near Field, and in order to procure a transfer of the grant of land at Golden, we were forced to delay the erection of our smelter until that grant would be obtained. This the Government has now given us, and we have obtained 320 acres of land at Golden on the condition that we erect our smelting plant at that place, which we will as soon as spring opens. You will see by this that the report which has reached you has substantial backing. All our plant, with the exception of engine and boiler has been purchased and paid for, and the smelter will be erected as mentioned. I have personally been interested in the mines in British Columbia for several years, and will in another letter give some reliable information in respect to the development now going on in the Kootenay District in that province, which I hope may be interesting to some of your readers.

Yours etc.,

P. MCCARTHY.



In General.

Many Canadian phosphate schemes are now on the move in London. The Phosphate Trust (Ltd.) with £1,000,000 capital referred to in our last issue is expected to come out publicly this month. This company has included in its prospectus large areas over which the promoters have as yet no control, but which, it appears, they would purchase if their appeal for capital is successful. Another large and similar enterprise is also spoken of as being in preparation, and we shall be interested to see if the English public have become aroused to the advisability of phosphate investments in Canada.

London letters state that Col. North's nitrate enterprises are languishing, and his followers are beginning to lose money. It is said he is sustaining their spirits by promises of fortunes in phosphate, and it is thought his attention may be turned to Canada as a field for operations.

A strong firm in London are endeavouring to organize an undertaking for the manufacture of super-phosphate at Buckingham, in connection with the North Star Mine and other Lieve

river properties as the source of supply for phosphate. The sulphuric acid is to be obtained from Capelton.

We are indebted to the thoughtfulness of Mr. W. H. Hutchinson, of the Anglo Continental Guano Works, London, Eng., for a number of samples of foreign phosphates for the *Review's* museum. These consists of

Bull River phosphate.....	55/60%
West Indian ".....	60%
Lahn ".....	40/50%
Sombrero ".....	75%
Welsh ".....	50%
Basic Slag.....	40%

The same gentleman writes *apropos* of the discussion upon the alleged discrepancies between the buyers' and sellers' chemists in the analysis of Canadian phosphate:—"I have just been looking up the analysis of some parcels of Canadian phosphate bought by us. The buyers' and sellers' analysis are:—

For Buyer.	For Seller.
83.94	84.48
72.39	73.45
80.69	81.54
75.40	75.96
86.60	86.87

from which you will see there was no great difference—not any like the discrepancy alluded to by Captain Adams."

The total production of South Carolina phosphate for the year 1889 is estimated to have been 423,720 tons.

The phosphate beds belonging to the State of South Carolina are valued at \$7,000,000. The State debt of \$6,000,000 is about to be refunded at 4 per cent., and it is proposed to sell the phosphate deposits and wipe out the debt at once. A bill to authorize the Comptroller General to advertise the beds for sale has been favorably reported by the Ways and Means Committee of the House of Representatives, which, it is thought, will pass, despite the strong opposition from the phosphate interests of Charleston. The advocates of the bill figure that the State would save \$8,000,000, so far as the State debt and interest thereon is concerned, by cancelling the debt with the proceeds obtained from an immediate sale of the phosphate deposits. For, assuming the beds to last for fifty years, the State's royalty would amount to \$11,250,000; but interest on the debt for the same time would amount to \$12,000,000. The principal, too, would become due, and the excess above the royalty would be upwards of \$8,000,000. A great advantage which the purchasers of the beds would have would be their ability to fix the royalty at any figure they might see fit. The State royalty is \$1 per ton. The phosphate business of Charleston involves many millions of dollars, and the proposed legislation will no doubt be vigorously resisted.

For the following particulars regarding the new fertilizing works now being operated by Messrs. G. H. Nichols & Co., at Capelton, we are indebted to the courtesy of Mr. H. W. Wigglesworth, who in a recent letter says:—"Our fertilizing works are now in full swing preparing for the coming season's demand. Here, in the Eastern Townships, little trouble is anticipated, our last year's start and the very satisfactory results obtained having given quite an impetus to our business locally. In Ontario, where we did little last season owing to the limited time left at our disposal, we look for a large demand for our product,

our travellers reporting most encouragingly of the prospects. In fitting up the works, with our extensive experience in the States to guide us, we have put in a plant, which, if it can be equalled can certainly not be surpassed on this continent. For breaking the mineral phosphate the Blake crusher is used, this machine, as is well known, doing its work quickly and effectively. From the crusher the apatite is carried by elevators to a hopper which feeds the new Griffin mill. This mill is worked on entirely new principles, and grinds from 25 to 30 tons a day, discharging it screened and ready to be conveyed and elevated to the dissolving floor; and it does its work so finely that much of the difficulty in dissolving is overcome. The acid treatment, of course, depends very largely on the analysis of the ore, and upon definite chemical proportions; our success in reducing to a minimum the insoluble phosphate has been very gratifying, and must prove a great boon to the consumer. At present we are about to add to the Chemical Works a new set of chambers in order to insure an unstinted supply of sulphuric acid for the Fertilizer department. For mixing the raw material and grinding the superphosphate we have put in a Walker & Elliott Disintegrator, a machine which is now being very largely adopted in the Southern States to replace Carr's disintegrator. It revolves at the rate of 720 revolutions to the minute, pulverising by a sort of tearing action. The various raw materials are fed directly and only require passing through and screening to be ready for bagging, and the market. The new Disintegrator should grind 100 tons per day. We have also an excellently equipped laboratory where all the raw material and finished grades are analysed, and by which we are enabled to detect any faulty manipulation before it gets too far. As you are aware the price of mineral phosphate has risen very considerably since the summer, but having been fortunate to secure a large supply before the advance, we are enabled to sell our different grades at as low a price as we did last year. The demand for fertilizers both in Europe and in this country gives us unbounded confidence in the future of this business in Canada."

The following circular letter, under date of 28th ult., is being freely distributed by the American agents of a London firm:

"We cannot help being amused at the innocent credulity of these Canadian property owners, who lend such a willing ear to every man-jack of a runner, who talks so glibly of a "cash purchaser" in London and a "cash deposit" to be had only for the asking, and who in all probability, has not enough money in his pocket to pay for a single night's lodging at a fourth-rate hash house. Cannot you, with all your American cuteness, invent some process whereby you can instil into the brains of these same Canadian property owners a knowledge of the fact that they are being deceived, tricked, bamboozled and made fools of by these runners, impecunious fellows, who, having heard of the formation of the Phosphate Trust, are resorting to every subterfuge, every fast and loose game, to secure options on properties which they will offer to the Trust at so enhanced a price that the properties will be thrown back on the owner's hands with every chance of their being sold, utterly lost. * * * Having been advised from your side that several London firms of good standing had representatives in Canada authorized to pay deposits upon and secure phosphate properties, we have taken the trouble to enquire of these firms as to the truth of such statements, and in every single instance

they emphatically assert that they have no representative in America, and that any person representing himself as such, is doing so without any authority from them.

Markets.

European advices report the market strong with an upward tendency. A rumour was current locally to the effect that contracts had been made at a higher figure than 1/4d. for 80%, but on enquiry we find that there is no truth in the matter. A London house owning mines on the Lievres River have offered some of their phosphate at 1/4d. without finding a buyer. A sale has been made at Hamburg at 1/3d. for 80%, which is equal to 1/2d. at London, and this may be considered the opening price of the season. The market is firm, but prices are to a large extent nominal, for the miners are holding out for higher figures than the manufacturers is willing to give just now.

Kingston District.

About 100 men are now working under Superintendent Harris at Capt. Boyd Smith's mines in this district. Pits are being operated at Eagle Lake, St. George's Lake and Silver Lake, at all of which phosphate in paying quantities is being raised. A brisk season is expected at these mines.

The *Financial Times*, London, under date of 18th ult., contains an interesting report of the meeting of the Foxton Phosphate Mining Co. After working for six months a dividend was declared at the rate of 20 per cent., per annum, and a reserve was carried forward. The pits continue to produce a regular output, and Messrs. Lomer, Rohr & Co. have now some 800 tons on hand. The average yield from this mine is over 80%. The working is also being extended to other "shows" on the property, and these are beginning to yield considerable quantities of ore.

Templeton District.

As foreshadowed in one of our recent issues, the Blackburn property has passed definitely into the hands of the East Templeton District Phosphate Mining Syndicate, limited, the capital of which has been subscribed privately. This syndicate intends to push matters with the greatest vigor. The company has started hauling their No. 1 phosphate to the river Blanche, and their No. 2 to Messrs. Lomer Rohr & Co.'s mill at Bassin-du-Lievres, which mill they intend to supply with about 1,500 tons of phosphate during the present winter. We should say that the new company has been registered with a capital of £6,000 sterling. We understand the property is to be paid for in the main by a system of royalties extending over several years, so that, it is expected, the mine will pay for itself out of its own profits.

We have also pleasure in stating that another new company has been registered in London under the name of the McLaurin Phosphate Mining Syndicate (Limited) with a capital of £20,000 sterling to acquire and work 1,800 acres of freehold mining lands in this district. These lands are most favorably located, and bear the reputation of being good mining properties. Operations will be begun immediately on Lot 7 in the 11th Range and Lot 10 in the 10th Range; both of these lots adjoin the well known Blackburn mine.

The management of both of these concerns is in the hands of Messrs. Lomer, Rohr & Co., the

well known shippers at Montreal, who have displayed so much energy and enterprise in the development of the Canadian phosphate trade.

Lievres District.

The Anglo-Continental Guano Co. of London are now selecting a suitable manager for their recently acquired property adjacent to the Emerald. Their prospector, Hogan, reports most favorably of his further exploration of the Aetna Hill Lot, upon which a cobbing house has been erected. As soon as the manager reaches the mine actual operations will be begun on a large scale.

Mr. Lainson-Wills, who recently examined the workings so far done on the property of the Dominion Phosphate Co., Limited (of London) states that the ground is opening up very well in both pits. There are 30 hands at present employed, including the cobbers who started work after the New Year. The holidays have retarded the delivery of the new steam hoisting engine.

The exploratory works at the Central Lake mines are now restricted to the driving of the north adit level during the winter season. The past year's work has been very successful in establishing the value of this property. The output of some 350 tons of rich phosphate will be hauled out by a new winter road to the High Rock Landing.

Captain Williams has between 50 and 60 men working in the North Star pits. The yield of phosphate continues to be most satisfactory.

Mr. J. Lainson-Wills sailed for England by the Umbria on the 18th inst. Mr. Walter Pickford, manager of the High Rock mines, also left for London on the 4th per SS. Etruria. Among other Canadians interested in the phosphate trade now in London are:—Mr. J. Hilton Green, of Messrs. Wilson & Green, Montreal; Messrs. George Stewart, and E. B. Haycock, Ottawa; Mr. C. M. Pielsticker, of the Dominion Phosphate Co. (Limited), Buckingham, &c. We believe that Mr. S. P. Franchot, managing director of the Ottawa Mining Co., Buckingham, also leaves at an early date. With such a galaxy of talent in the field it will indeed be strange if we do not hear of some important transactions in Ottawa county mines and phosphate lands.

Mr. O. M. Harris, of Montreal, who has just returned from a visit to the pits of the Canadian Phosphate Company, reports very favorably of the work now going on there. Every preparation is being made for an active season.

During the past year considerable prospecting and development has been done on the Little Rapids mines with most gratifying results; these new workings have revealed large masses of apatite in paying quantities, and fully confirm the reports of the high value of this property as a producer of Canadian phosphate. A third shaft is now being sunk at a point about 500 yards west of shaft A, and in this

rich and promising mass of ore of exceptional purity has been uncovered; the present depth of this shaft is now about 40 feet. Shaft A is 190 feet, and shaft B 210 feet deep, and all the levels are now in good ore. We understand that active operations are to be begun early in the spring.

The frequent freshets have been very annoying to mining operations on the river.

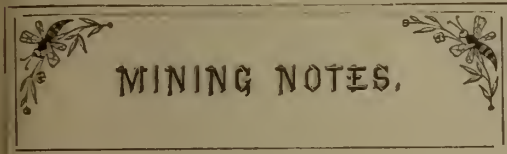
Captain Henwood has struck a good body of ore in the north workings of the Emerald.

Perth District.

Contract work continues with gratifying results at the pits of the Anglo-Canadian Company.

Wakefield District.

Messrs Seybold & Gibson, Ottawa, have recently purchased the Moore mine in this district for \$5,000 cash. The property consists of some two hundred acres, and is registered as the north half of lot 12 and the south half of lot 13, 1st range Wakefield. Small development work has been done and some phosphate shipped. The new owners will commence operations immediately.



Nova Scotia.

In General.

The shipments of coal during the season of 1889 are reported to be somewhat less than the year previous. The figures being:—

Cumberland County Mines.....	418,932 tons.
Pictou County Mines	386,254 "
Cape Breton Mines.....	754,964 "
	1,560,150 "

or a decrease of 16,541 tons compared with the returns for 1888.

The Londonderry Iron company recently sent an agent to examine the deposit of red hematite occurring at Torbrook, near Wilmot. The bed is reported to be six feet in thickness, and to average 62 per cent. in metallic iron. It is understood that leases have been signed covering nearly two miles in length of the deposit.

Waverley.

On the 1st of Jany. the Lake View Mining Co. reported 900 feet of levels and crosscuts driven since July. All of this development work is at the 340 ft. level. In driving west a fault has been struck, and in crosscutting north along this fault several new lodes have been found which have never cropped to the surface. Some of these new lodes look very promising, being from three inches to 10 inches thick, and estimated by Mr. Hayward to be worth from \$15 to \$25 per ton.

In West Waverley one small lot of quartz from the Palgrave property has been crushed, which yielded at the rate of \$18 per ton. Only one battery of the mill has been run, the others not being in condition. A small force of men is kept continuously busy.

The Gue and Wilson property in West Waverley has been working during Dec. and Jany. The

shaft in the Union lode, having a depth of 240 feet, has been pumped out and cleaned up. It is the intention of the management to sink the shaft to a depth of 300 feet, and then open up the property by levels and crosscuts at that depth.

The crosscut tunnel under Laidlaw's Hill is progressing slowly, having now a total length of about 450 feet. The famous "Barrel Lode," which is the *raisen d'etre* of this tunnel has not yet been reached.

Oldham District.

Work in this district is very dull, the tribute work last month being of a very unsatisfactory nature. The property of the Oldham Gold Co. is yet in the hands of the Receiver and is practically idle, only two men being employed.

Central Rawdon.

The mill at this mine started up again this month after being refitted with a new engine and new boiler; but Manager Willis expresses doubt as to how long the batteries will be able to run, and says a new mill is a necessity of a pressing kind. The old workings of the mine have largely had to be abandoned, and a new shaft has been started in the vein. The character of the country rock at this mine is different to that of the gold measure proper, being easily weathered, and swelling and shaling off upon exposure; these characteristics have necessitated extra precautions in timbering both old and new openings, and have made progress somewhat slow. From developments made, the manager predicts a prosperous future for the property.

Salmon River.

Mr. Geo. A. Leslie of Halifax has sold his one-eighth interest in this mine to Gardiner Clish and A. K. Archibald of Truro. It is reported that the mine is looking better in its central portion.

Stormont District.

The Palgrave Gold Mining Co. of Isaacs Harbor has employed J. E. Hardman, M. E. to furnish the design and plan for a new ten stamp mill, and a new hoisting and pumping gear, with engine and accessories. The mill and plant are to be erected upon Hurricane Island this spring if the plans are approved. The eastern portion of the company's property has recently had a thorough separate test of its value per ton. The results were exceedingly good, and add very considerably to the value of the mine.

Mt. Uniacke District.

The Phoenix Co., under the management of Mr. H. B. Prince, is giving the low grade ores of this district a very thorough test. From results obtained from Mr. Prince, it appears that

Gold Mining Supplies.

The principal depot in Nova Scotia, carrying the most complete assortment of first class goods, is

H. H. FULLER & CO'S,
41 to 45 Upper Water St., Halifax, N.S.

Our line comprises Explosives, Fuse, American and English Mill and Hammer Steel, Bar and Bolt Iron; Steel Wire Hoisting Rope, Hemp and Manilla Rope, Rubber and Leather Belting, Miners' Candles, Oils and Lamps, Miners' Tools, Machinists' Tools, Blacksmiths' Tools, and every requisite for the gold miner.

H. H. FULLER & CO.,
Halifax, N.S.

the total cost of mining and milling including incidental and general expenses does not exceed \$2 per ton. The ore belt worked has an average thickness of 8 feet, and will yield from four to six feet of crushing material. It is believed that is the lowest cost per ton ever attained by any gold mine in the province.

Whiteburn District.

The McGuire mine at this place closed down indefinitely in December. It is understood that some changes in surface plant will be made before resuming work. The Graves mine is working full time with a force of 60 men.

Killag District.

Mr. Geo. W. Stuart has been busy this month removing his steam gear to the lode found in October, of which mention was made in the Review for November. As soon as the surface plant is ready mining operations will be resumed.

Renfrew District.

Mining matters here are very quiet. Both the Empress Co. and the Free Claim Co. have but half a dozen men, or thereabouts, each employed. It is understood that both properties are not looking so well as in the summer.

Pictou County.

During recent years the Acadia mines have greatly increased their production, and the past year has been no exception. The yield for 1889 shows an advance of 5,867 tons over last year, the returns given being 101,018 tons as against 95,151 tons in 1888. With a new hoisting plant and other facilities recently added, the prospects are good for a larger output during the present year.

Although there has been an increase in the sales of coke, the exports of coal from the Albion are still sadly in arrear, but it is hoped that the worst period in the history of this unfortunate mine is now passed, and that henceforth there will be a notable improvement in production. The shipments for 1889 are 52,668 tons against 64,388 tons during 1888, a decrease of 11,720 tons. The coke sales amounted to 15,839 tons.

Notwithstanding the small force at work in the pits, the production from Black Diamond shows a healthy advance on the previous year's operations. 1889, 32,416 tons; 1888, 23,686 tons; increase 3,700 tons.

The development of the iron deposits of Pictou county promises to be an immense industry. There are two companies about commencing work. One is American, and the other provincial and British capital. The American company has surveyed a road from their works to New Glasgow, some 18½ miles. They claim 40 square miles of iron and coal property. It is their intention to erect blast furnaces only, the ore being converted by this process into pig iron. The works in connection with the blast furnaces will cost about £40,000. Should a subsidy be granted, the company say they will extend the line to the sea coast. It is the intention of the local company to erect blasting and smelting works. The iron works at New Glasgow will take a great part of the output of the latter. It is believed that the part of the country in which these mines are located will become a second Pittsburgh.

We are glad to learn that the prospects of recovering the Foord pit are growing brighter. Explorations have been made a distance of over 150 feet on the north level, and the look of

things encourage the belief that it will pay to continue clearing up. Eight boxes of coal standing in the level were found only slightly charred. Since writing the foregoing we rejoice to hear that on Monday night the workmen proceeded half a mile on the level finding everything in excellent condition, the rails unmoved, etc.—*Stellarton Journal*.

Cumberland County.

The Springhill collieries have exported about 2,000 tons more than in 1888, the total export being 366,000 tons against 364,036 during 1888. In the early part of the year but little work was done at the pits, but during the last three months there has been great activity which is likely to continue for some time.

An improvement is noticeable in the yield from the Chignecto Pits, the figures for 1889 being 13,645 tons, as against 10,910 tons during 1888, an increase of 2,735 tons. Had there not been a scarcity of cutters more coal would have been sold.

The returns from the Joggins collieries show a falling off of 5,316 tons compared with 1888, the figures being 37,937 tons. This is not owing to any decrease in the demand for the coal, but simply from a failure to start the leading places in time, thus creating a scarcity of pit room. The works are now in a better position than ever before, and there is good reason to believe that the production during the present year will be largely in excess of the season just closed.

Cape Breton.

Although handicapped by the want of a railway and shipping place of its own, Bridgeport again has a slight increase.

There is little difference in the returns from the Caledonia compared with last year, the figures being:—1889, 102,525 tons; 1888, 102,931 tons; decrease, 400 tons.

The Gowrie mines show a decrease of 8,127 tons; of round there were shipped 83,572 tons, and of slack 16,573 tons. The total export for the year was 100,145 tons.

The International has been by far the most productive of the Cape Breton mines, and shows an increase of 23,419 tons over 1888. The total shipments were 113,063 tons, of which 95,707 tons were round coal, and 27,358 tons, slack. Work was steady in all the pits and fair wages were earned.

At Little Glace Bay the output is 3,400 tons less than in 1888, the decrease being attributable to an increase in the rate of freight, on account of which the full quantity of coal ordered at the beginning of the season was not called for. The returns are:—1889, 74,000 tons; 1888, 77,405 tons.

The coal from the Sydney mines is largely used for domestic purposes, and the shipments, therefore, vary little from year to year. The exports for 1889 were 125,060 tons, or a slight decrease from 1888.

Excellent work was done at the Victoria mines, and the yield shows a strong lead over the previous year's operations. The total quantity was 88,900 tons, or 16,400 tons more than 1888; 6,900 tons of slack were shipped from these mines.

The quantity shipped from the Reserve mines comprises 925 tons round and 16,846 tons slack, a total of 106,771, as against 109,063 tons in 1888.

New Brunswick.

The Brunswick Manganese Company's stock has been admitted to the unlisted department of the Boston Stock Exchange. The property is located at St. Martins, in St. John county. Shares, \$40,000; capital, \$100,000; transfer office, 34 Oliver street, Boston. Herbert H. D. Pierce, president; George D. Hall, jr., treasurer, and they with James A. Tilden, W. R. Stockbridge and John A. Loring are directors.

Quebec.

The exports of Canadian asbestos for the fiscal year ended 30th June last are officially stated to have been:—

	Tons.	Value.
No. 1 quality	4,228	\$304,336
No. 2 "	237½	11,192
No. 3 "	183	8,358
Total tons.....	4,648½	\$323,886

The following were the exports for the twelve months ended 31st December last, as per official returns received by us:—

From Coleraine	Lbs.	249,400
" Black Lake	"	3,450,020
" Thetford Mines	"	8,166,360
" Broughton	"	16,000
" Levis	"	32,000
	Lbs.	11,913,780

or 5,956 $\frac{1780}{2000}$ tons. This is a most satisfactory increase over 1888.

Work continues lively at the pits of the American Asbestos Company, Limited, at Black Lake. Their No. 3 pit is in excellent condition, and never appeared as good as at present. The veins are all large and well bunched. Up to December they were working a force of about 80 men, though at present their force is not quite so large. In November they mined 96 tons of asbestos, and about 34 per cent. of this was No. 1. This is much higher than the average of Black Lake mines. The machinery of this company was only put in operation about July 28th, 1889, yet, notwithstanding this, they brought their output for year ending November 30th, up to 511 tons. Beginning December 1st, 1889, it will be known as a limited company. They are adding a number of houses for their workmen this winter.

Mr. A. Steele, Supt. Que. Central Ry., and Mr. John McDonald, of McDonald Bros., Sherbrooke, have leased a Lot on the opposite side of the lake from the above works. This will be known as the "Central Mine."

The United Asbestos Company, Limited, are putting in a plant of hoisting and air compressing machinery. The plant is built by the Jencke's Machine Company, of Sherbrooke, and from what we see of the machinery already on the ground it is a credit to that company. There are two 70 h.-p. steel boilers, duplex 7" x 10" "Bacon" hoist, and 16" x 24" Rand compressor. These will be put in position as soon as possible; the engine house is nearly completed, and it is expected that all the machinery will be ready for work in a few weeks. At present a force of about 35 men are employed. In a new opening now being worked there is an excellent showing of asbestos.

Southward mine,—Bell's Asbestos Company—is closed for the winter.

The Anglo-Canadian Asbestos Co. Lt., have reduced their force of men for the winter. They are opening a number of new pits, and if they show up well their output will be largely increased for the present year. We understand that Mr. R. T. Hopper intends adding some new machinery in the spring.

The Coleraine Mining Co. has leased several lots of mining land to different parties.

Next to Johnston & Loomis, the St. Julie Mining Co. have taken a Lot. They are working a few men now, their work at present being entirely confined to prospecting their property.

Next to the above comes what is known as the Black Lake Mining Co. A few openings have been made on this Lot and some nice veins of asbestos uncovered.

The Laurier Mining Co. has acquired a Lot adjoining the Anglo-Canadian Asbestos Co. Lt. Very little work has been done as yet. They intend opening in the spring.

One or two other places have been leased by other parties, but no particulars can be obtained.

From the present outlook, we should say that the coming season will be the busiest that Black Lake has ever known. All the established mines are looking forward to a large year's work. Some of the mine managers are puzzling their heads over the labor question, as it is now, the men are scarce and most of the mines are short-handed. In the early spring the different companies will have to increase their forces by a considerable number, and it looks as if there will not be enough men to go around.

The American Asbestos Co. are getting a number of Belgian workmen out. Mr. Ed. Werthiem, Managing Director of this company, is expected to return in February.

The exports of copper ore from the Eustis and Capelton mines for the twelve months ended 31st December, as per our official returns, were 43,110 tons, and in addition to this there were shipped 1500 tons of copper matte. The shipments of ore and matte from the Harvey Hill mines during the same period has been very small, only some 255 tons having gone forward.

The value of the exports of Felspar from the Villeneuve mica mines for the quarter ended 31st ult. was \$487.50.

From the Bristol Iron Mines, during the same quarter, ore to the value of \$7,087.31, or 259½ tons, was shipped to the United States.

Ontario.

In General.

Notice of application for letters patent of incorporation has been published on behalf of the Gravel Bay Mining Company, the object being to work the Vulcan location, situated six miles north of Gravel Bay Station on the Canadian Pacific Railway. Five well-known gentlemen are the promoters, namely: Hugh Wilson, P.L.S., Mount Forest; Judge Kingsmill, Bruce; F. T. Sibley, formerly of the Silver Islet Company; W. E. Price, of Montreal, and Mr. Walter A. Dixon, of Toronto.

The location is 160 acres in extent. Assays of the ore by Prof. Chapman, of Toronto, give 60 per cent. lead and a high percentage of silver and gold.

We hear, writes the *London Iron and Steel Trades Journal* that a well known American engineer has prepared plans for six large blast furnaces, which are to be erected near to Ottawa, and we see no reason why pig iron production on a large and profitable scale should not soon be an important feature of Canadian industry. It is only a matter of time, and we believe that movements now on foot are likely to accelerate the event. The enormous production of pig iron in the United States has now rendered the great Republic practically independent of external supplies of crude iron, and we must be content to accept the inevitable and see Canada also become self-supporting in the matter of pig iron.

Sudbury District.

The Canadian Copper Company has closed down the Stobie mine for the present owing to the overcrowding of cars in the Sudbury yard incidental to the rush of business over the "Soo" branch of the C.P.R. Such a block has been created here that it has been impossible for cars hauling ore from the Stobie pits to get across to the Roast yard at the Smelter. The closing of these pits will throw about 40 men out of employment.

The "Copper Cliff" continues to do well. A rich strike of ore was lately made in the fifth level at a depth of 520 feet from the surface. About 130 men are employed here.

A force of about 70 men is employed at the "Evans" under the superintendence of Capt. James, formerly identified with the Coe Hill mines. About 100 tons carrying 8 per cent. copper and from 2 to 3 per cent. nickel are raised here daily. A pile of 1,500 tons has just been roasted at this mine. All the ore, however, is not roasted here; several car loads per day being shipped to the Roast-yard at the Smelter.

The smelting operations, in which about 60 men are employed, continue to give great satisfaction. No. 1 furnace is at present idle, the trestle having been taken down to allow the construction of a dump beneath it and to admit improvements in running out the slag from No. 2.

The Dominion Mineral Company continues the development of their property. About 60 tons per day are being raised. The management are also roasting their ore. The Smelter has not been put up yet.

The Murray mine is also working, and is doing good work.

The *Globe*, in a recent issue, has the following comment on the proposed extension of the Central Ontario Railway from Coe Hill, its present terminus, to the Sudbury mines:

It is understood that the Railway and Mining Companies are prepared to undertake the construction of the road to Sudbury, the erection of a furnace somewhere on the line for making coke iron with a capacity of 250 tons per day, and the extension of their smelting plant at Sudbury to a capacity of 1,000 tons per day, on condition of receiving certain subsidies from the two Governments. These mining and smelting industries would give employ-

ment to a very large number of men from the outset, and would be a boom of immense value to a section of country that has been for some time in a very depressed state—the counties of Northumberland, Hastings and Prince Edward. The circumstances, too, seem to favor some town or city of Ontario as the location of works for the manufacture of nickel-steel, and for the refining of nickel and copper ores. The plant for the manufacture of nickel-steel alone would, it is stated, cost \$3,000,000, and the Canadian Copper Company has received offers of any financial aid they may require from British, French and German capitalists should they go into the enterprise. We learn on good authority also, that the Governments of Great Britain, France and Germany have each made an offer to purchase all the nickel which the company can produce in the next ten years, but probably these offers have been made without any conception of the possible output of the Sudbury mines.

Port Arthur District.

The year 1890 opens well for the Port Arthur District. The Badger Mining Company, owners of the Badger silver mine near Port Arthur, have just declared a first dividend, payable January 15th, of 50 cents per share on 50,000 shares, equivalent to 10 per cent. on the total capital stock of \$250,000. This is all the more remarkable when it is considered that the mine had previously returned to the proprietors all the original capital invested in the lands, buildings, mining works, machinery and mill, besides having ample cash for ordinary working expenses still left in the treasury.

The December shipment from the Badger consisted of 15 barrels of high grade ore and 13 barrels of concentrates; value \$17,000. Everything looks prosperous and business like around the mine. Several men are employed. The mill is running night and day.

Owing to the mild weather and heavy snow fall, the water in the Silver Creek still continues sufficient so that the anticipated closing down of the mill, owing to shortage of water, is still delayed.

The location of the railway through the mining region is being pushed, and no doubt there will be changes made which will shorten the line and assist in the more economic working thereafter. In the meantime, the present terminus of the road at the Kaministiquia River Crossing—called "Stanley" in commemoration of the Governor General's recent visit—is quite a busy centre.

The West End Silver Mining Co. held its meeting in Port Arthur lately, and has made arrangements for more vigorous work at this most promising mine.

The various veins on the Beaver mining property are being energetically and economically developed by the able manager, Capt. Hooper, who has also the management of the Elgin mine near by, which promises in the near future to be a rival of its older sisters, the Beaver and Badger.

The diamond drill is still enquiring into the depths below of the Beaver; when some 1,500 feet have been penetrated, the drill will doubtless be put to work to test the vein proper at various depths.

Work is going steadily on getting out lumber, etc., for mills, houses, etc., at the new town site of Kakabeka. The company is now being organized in Philadelphia, and on the return

shortly of the business manager the tunnel for the utilization of the water power for smelting and other purposes will be commenced.

The shipments of last winter from the Shuniah Weachu were 22 tons of a value of \$10,000. All the workings continue to do well. Excellent stopping ground has recently been opened.

The main shaft of the Wolverine is down 130 feet. The vein is improving with depth, but some difficulty is experienced with water in the shaft.

A rumor is current that the Porcupine has been sold to an English syndicate. The price mentioned is \$50,000.

Rat Portage District.

It is announced that English people will take control of the gold mine on Sultana Island, and that operations will be begun in the spring. It is said that the syndicate has an option to purchase the property after testing it.

British Columbia.

The Revelstoke Mining Co., with a capital of £40,000 was registered at Victoria on the 23rd inst.

The output of coal from the mines at Vancouver Island during the past year has been largely in excess of any previous year. The total production, estimating that of the East Wellington Colliery at 35,090 tons is 548,503 tons, of which the Wellington mines furnished nearly 50 per cent. Placing the value of the coal at \$4.50 per ton at the pits mouth, the total represents a value of \$2,468,263. These mines give employment to over 2,300 men.

The following are the returns furnished by the different companies:

WELLINGTON COLLIERIES.	
Foreign shipments.....	196,510 tons.
Home consumption.....	70,524 "
Total	267,034
Number of men employed, 900.	
UNION COLLIERIES (6 MOS.)	
Foreign shipments.....	27,551 tons.
Home consumption.....	100 "
Total	27,651 "
Number of men employed, 450.	
NEW VANCOUVER COAL CO.	
Foreign shipments.....	179,953 tons.
Home consumption.....	38,000 "
Total	218,818 "
Number of men employed, 845.	
EAST WELLINGTON COLLIERIES.	
Foreign shipments (estimated).....	35,000 tons.
Grand Total.....	548,503 "

The New Vancouver Coal Company has prospected extensively during the year, and has recently put a shaft down to the famed Wellington seam, and found coal of good quality. It is the intention to put this coal on the market this month.

A large force has been employed at the Union Collieries opening up the mines at Union Bay, near Comox. It is expected that early in the year the property will be opened up sufficiently to permit the production of a large output, the company being under contract to the Southern Pacific Railway Co. to furnish 7,000 tons per day.

Considerable interest has been taken and a good deal of money spent last year in the claims in the neighbourhood of Kootenay Lake, but the want of a railway and the difficulties of transportation are still felt to be serious obstacles to the rapid development of what otherwise is a most promising field.

With increased facilities for production at the Wellington and Vancouver pits, and the assured improvements at the Union, there is every reason to anticipate a very much greater increase in the output of coal during the year just begun.

The Wellington and Vancouver Coal Companies have greatly extended their operations; the former has lately put down a shaft and found abundant coal of excellent quality.

Messrs. Wells, Fargo & Co. report an increase of \$15,751.47 in the shipments of gold dust from the province during the year. The following are the figures for 1889:—

Bank of British Columbia.....	\$253,123 87
Bank of British North America.....	46,489 64
Garesche, Green & Co.....	188,580 11

Total, 1889.....\$488,193 62

At the Nicola Mining and Milling Co's "Joshua" claim, in the Nicola district, about 28 miles south of Kamloops, a shaft is sunk 400 feet, while a tunnel has been drifted in one direction 600 feet, and another in a different direction, 1,100 feet. In addition, levels have been run from the shaft at every 100 feet, these extending from 150 to 250 feet. The "Tubal Cain," owned by the same company, is down 220 feet, and the "King William," another of these claims, is down 200 feet. There is now lying at Kamloops Station a 30 H. P. engine, with boiler, and 1,000 feet of wire rope recently purchased for hoisting purposes at the "Joshua" and other claims. This machinery will be taken out and set in position at once so that operations may begin early in the spring.

The "Mary Reynold's" claim, owned by J. Hepburn & Co., has now three shafts—one 100 feet, one 75 feet, and one 35 feet, all on the same vein. Drifts are also run from the 100 feet shaft, a distance of 90 feet; 3,500 tons of ore have been shipped to San Francisco, averaging \$163 to the ton. There is estimated to be \$10,000 worth of ore on the dump, averaging from \$50 to \$60 to the ton.

On the majority of the claims located in the Nicola district only assessment work was done during the past year. Several causes have led to this result, but probably the most potent was the closing down of the Star Mining Company early in the spring, followed by the burning of the quartz mill and other plant connected therewith. The prospects for a renewal of active operations during the present year are, however, good, the success of the Nicola Milling Co. having inspired confidence in the future of this promising field.

In the Illecillewaet district the development of a number of excellent claims proceeds steadily, and much activity is predicted during the coming season. Want of a home market where the value of ores could at once be realized, the difficulty and expense incurred by shipments of ore over long distances, and the lack of the necessary capital required to open up new claims, have been the great drawbacks

against which the poor prospector has had to struggle in recent years. But the outlook is more encouraging. A smelter has lately been erected at Revelstoke by a wealthy syndicate, and although the sampling works only have as yet been in operation, the management are prepared to receive and pay cash for the value of all marketable ores. The erection of these works cannot fail to be productive of the most beneficial results, and will undoubtedly prove to be a most important factor in the mineral development of the district.

But little work was done by the Cottonwood Gold Mining Co. Early in the year an excellent trail was graded from Nelson to the mines—four miles. The machinery imported was, however, found to be very defective, the so-called expert proved incompetent, and operations were early suspended. It is reported that the management intend to introduce a better plant this year.

A large number of improvements have been made at the "Poorman Gold Mine" which passed into the hands of the present company in the spring, at a price, it is said, of \$35,000. A Pelton wheel, to run under a head of 250 feet has been set up, Eagle Creek supplying the water. A large number of buildings have been erected, an expenditure of \$30,000 being represented in the labor and plant provided. Mr. Nail, the manager, is wintering with a gang of men at the mine, and expects, with the running of his mine in the spring, to turn out more than enough gold to cover all the expenditure.

Much of the progress of the Kootenay Lake district is entirely due to the energy and enterprise of Dr. W. A. Hendryx, an American physician, who first became acquainted with the country and its rich mineral resources during a shooting excursion in the fall of 1884. Impressed with the district as a basis for investment, he formed the Kootenay Mining and Smelting Co., and started work on the "Blue Bell," a claim notorious in its connection with its former owner Sproule, who, it will be remembered, was hanged in Victoria for the murder of a miner working on an adjoining claim. Obtaining a charter from the Territory of Idaho, Dr. Hendryx put through a waggon road from Kootenay Station to Bonner's Ferry. Until the end of last season this was maintained as a toll road, but it has now been sold to the county. It is free of tolls and is to be rebuilt. The doctor put a small steamboat, the *Surprise*, upon the river, and a year or two later added the *Galena*, which latter boat was enlarged and equipped with new machinery last winter. These boats and the *Idaho*, built by a Mr. Foy, have carried in the miners and the freight, and all the ore from the mines.

Some months ago the Government Reduction Works in Cariboo were set in operation, but it is generally known that the results were not very satisfactory, inasmuch as by the processes adopted only some 60% of the gold contained in the rock operated upon was secured. In order to attain better results a chlorination plant was added, and was put to the test lately with results that have proved eminently successful. On 23rd instant the Minister of Mines received the following telegram from Mr. E. A. Martin, the Superintendent at Barkerville, "Chlorination perfect success. Five trials. About eight tons yielding over 90%."

Development work upon the "Blue Bell" has never ceased since it was acquired by this company. Tunnels have been run into the bluff from all sides, and everywhere the material in good paying quantity has been struck. A working tunnel has lately been run in from the water front, and an engine and drill, with a small force, are now at work there.

The Toad Mountain Silver Mines, operated by the Hall Co., are reported to have yielded gratifying results on the year's operations. This valuable property has, however, been involved in litigation, and it is to be feared that further trouble is ahead, as it has lately leaked out that a couple of gentlemen from Victoria have visited the ground and staked out and recorded claims on the property now operated by the Hall's, as the "Kootenay Bonanza" and "Silver King" mines.

Silver Exports from Port Arthur Mines, 1889.

The following are the official returns furnished the REVIEW for the year ended 31st December last:

1889.	Silver Ore.		Bullion.		Total.
	Tons.	\$	Oz. troy	\$	
January....	1	1,050	.....	.....	\$ 1,050
February..	18	25,200	3,900	3,900	29,100
March.....	.....	.....	.....	.....	.....
April.....	.....	.....	1,293	1,293	1,293
May.....	.....	.....	.....	.....	.....
June.....	12	15,000	.....	.....	15,000
July.....	.....	.....	.....	.....	.....
August....	9	2,500	.....	.....	2,500
September..	32	48,630	.....	.....	48,630
October....	39	60,000	.....	.....	60,000
November..	40	41,480	1,920	1,200	42,680
December..	15	10,000	1,941	1,800	11,800
	166	\$203,860	9,054	\$8,193	\$212,053

Company Floating in London.

BY A CANADIAN

Standing in Rotten Row, watching the never-ending procession of costly equipages, a man remarked in a tone of soliloquy, "There's great wealth in London!"

A man in the "city" said, "I know a hundred and fifty Americans who are here trying to float companies."

These remarks illustrated the saying "Where-soever the carcass is there will the eagles be gathered together." Possibly some ardent student of prophecy will also see in the mention of the feathered emblem of America a prediction of the second statement.

Wealth and wealth seekers are natural associates, and the fame of the riches of London draws to it from all the world those who can offer inducements for the investment of money. All sorts and conditions of men are represented in this group,—the railway king, the finance minister, the miner, rancher, inventor, schemer, and those who agree with the Tichborne claimant when he remarked, in language not suggestive of an aristocratic education, "There's men that has money and no brains, and men that has brains and no money. Them that has money and no brains was made for them that has brains and no money."

The favorite mode of securing investment is through the formation of limited liability companies. Prior to the year 1856 persons who invested in a joint stock enterprise were ordinarily liable individually for the whole debts of the concern, and many people were ruined by investing merely small amounts in undertakings that became bankrupt. In that year the principle was introduced in England of limiting the liability of an investor to the amount subscribed by him, so that whatever the fortunes of the company he could not be called upon to pay anything beyond the sum he had promised. In 1862, and in subsequent years, this principle was embodied in the "Companies Acts," and the details for the formation and management of such companies were fully prescribed and regulated. In consequence of this legislation an immense impetus was given to investment in that direction, and the number of companies attempting to float every year in England is something enormous. In consequence, the promotion of companies has become an established business, the methods of which are peculiar and interesting. Many companies are formed privately; the capital is subscribed through personal solicitation and the only necessary legal measure is for seven persons to sign the memorandum and articles of association setting forth the nature and regulations of the business. These have to be registered at Somerset House in London, after which, if approved, letters of incorporation are issued.

But the great multitude of schemes do not get their capital so easily and cheaply. There are many variations in the methods, but some of the most common means of floating companies are as follows:

An American has a gold mine in Colorado that he wishes to sell for £50,000. He seeks a "Company Promoter" in London. No one has a sign hung out bearing that name, but the article is often to be found under the sign of "financial agent," "broker," "accountant," "solicitor," "attorney," or without any designation. The promoter takes the papers and studies them. If attractive he makes an exhaustive examination, and there are few sharper or keener men in the world. He looks to see if it is genuine, and if it would "take with the public," the latter being with some the chief consideration. If he decides that the scheme has merit and will "go," he visits several capitalists, who form a syndicate and agree to float the company and pay for the mine the amount asked, but paying as much of it as possible in shares. They increase the price of the mine from 25 to 100 per cent., the increase being to cover expenses and pay them a profit for "underwriting" the company. The needed working capital is added to the price of the mine, £75,000 for the mine, and £25,000 for working funds, making the total capital £100,000, which is divided into shares of £1 and upwards; £1, £2 or £5 being the most popular; and £10 being the most genteel.

Now a telling board of directors must be got. The promoter has a list of men and their prices, needy men of title and position, who for an "honorary" a yearly remuneration of £50 to £100 and a fee of a guinea for each meeting attended, are willing to lend their illustrious names and give the investors the benefit of their oversight of business experience. Such men are termed "guinea pigs," and many noble persons are enrolled in the list. A full-fledged duke may be had for an "honorary" of £1,000. A right hon. captain may accept £500, and a member of parliament may be had for £250. A weighty list of names, five or seven in

number having been secured, with eminent firms as bankers, brokers, auditors and solicitors, each of whom perhaps receives a substantial honorarium, a glowing prospectus is written and printed, and after a dozen revisions to see that it is within the bounds of the law and that every clause is calculated to impress the public, it is approved for circulation.

The syndicate do not propose to risk any cash, and the next step is to go to an advertising agent, who estimates the cost of printing and circulating 100,000 prospectuses and of advertising in all the leading papers of the United Kingdom. This being determined, he seeks a "syndicate" who will advance the money for expenses and take the risk of the company's "going into allotment." If the capital is not subscribed by the public this amount will be less, but if the company "floats" it will be repaid three or fourfold according to judgment of the risk taken. Occasionally the expenses of a company of great promise are advanced and insured for "two to one," but mines are seldom taken at less than "three to one," that is, for each thousand pounds advanced three thousand are paid.

All being arranged, the prospectus and forms of application for shares are printed. They are sent to an agent who employs perhaps 250 men working night and day addressing them. The lists of addresses are made up from the share lists of companies and are classified so that separate lists are kept of investors in mines, railways, manufactures and special branches of trade. Some agents claim their lists to have such value, owing to judicious selection, that they charge five per cent. upon the capital merely for addressing the prospectuses. The clergy are almost always included in the list as they have often a surplus from the salary to invest and are supposed to be less able to criticise than laymen.

The post office is notified to send its vans and the whole batch of prospectuses is posted on one evening, and the next morning every great daily paper has the prospectus in its advertising column, and a notice of the company in its money article. Thus the prospectus and the paper bring their joint message to the investor, and if he favors the scheme he signs the application and sends it with a deposit to the bankers of the company.

Now the trouble begins for the promoter. The papers that have not been favoured with the advertisement and the numerous weekly "financial" papers flock to the office with promises of favourable leading articles and ominous intimations of what will happen if the advertising is held from them. The editor of the *Christian Union* sends his compliments and proposes to make "special and favourable mention" of the company, enclosing the proof of a leading article elevated to fulsome adulation of the enterprise. The neglected papers at once prepare denunciations and exposures of "the great swindle," they bring proofs to the promoter in hopes of being bought off, and, if he is abduate, the abuse appears in the next issue, and the admiring public glory in the fearless courage of this standard of honesty that dares to expose wickedness.

Members of the stock Exchange go to the brokers' office and ask them, "Are you going to support the market?" If the answer is "No," they leave the matter to the mercy of the investing public; but if the answer is "Yes," they send in applications for shares and begin buying and selling them among themselves, running the price up to a premium. This attracts outsiders who buy for "a quick turn,"

and as soon as the shares are unloaded on these people the apparent demand ceases. The majority of the companies are subscribed for in this way by brokers and speculators who desire to gamble with the shares and make quick profits. The number who invest genuinely for the sake of future dividends is small. The business is so overdone that the daily receipt of prospectuses goes into the waste paper basket. One scheme that sent out a million prospectuses got no applications. But anything that seems likely to "go to a premium" is rushed after. Each applicant asks for five or ten times more than he wants, in order to be sure of an allotment of the number of shares desired. Thus the capital is subscribed for over and over again when perhaps there is hardly one genuine investor who means to let his money remain in the shares in hope of dividends. The shares are taken merely as gambling counters in the hope of selling them at a profit before they need to be paid for. A year or two ago in London a timber business that had some great names on its prospectus was subscribed for twenty times over; a dog biscuit company had also twenty times the desired applications; a company for boiling down dead horses was subscribed for ten times over; a cigarette company got five times its capital subscribed. The success of the timber concern made promoters think that the public were waking up from their lethargy. In the next week 34 new companies were registered, only some of which went to allotment and of these only two were fully subscribed for. People think all this capital sought investment, but the figures no more represent cash than do the aggregate transactions of the Chicago Produce Exchange. Shares are applied for as grain is bid for, merely to sell over again without passing money.

But we have left our ideal mining company on the first day of issue. If applications come in freely, announcements of the fact are put in the papers, and it is advertised that the lists will close in one, two or three days. This is expected to hurry up investors. If the shares have been sufficiently taken up to give enough capital to pull through with, the company sends out its letters of allotment and has "floated."

There are said to be more company wreckers than promoters in London, and these now have their innings. The wrecker goes to the office and demands the list of shareholders, offering the legal fee for the same. This is given through fear of a summons from the Lord Mayor if refusal is made. The "financial paper" containing the most abusive article is mailed to each shareholder with a letter from a lawyer stating that the affair is a swindle, and if entrusted with the case he will endeavor to recover the deposit money. Armed with appealing letters the wrecker, who may be the lawyer, enters the company's office, expresses regret that such bad reports have got out and that his clients are so alarmed. He expresses confidence in the enterprise and intimates that if £500 should be given to him to distribute among the frightened shareholders, he can "square them." If the concern is really bad, the £500 is paid; the wrecker pockets it, and writes to his clients that the company is sound, and they have been misinformed.

When a company is proposed, it is generally assumed that it is a scheme for plunder, and every one rushes for a portion. Thus the large figures on the prospectus are divided among a numerous crowd, and the envied vendor, who appears to be reaping a rich harvest, sometimes barely escapes with the coat on his back.

It makes a much better impression on the public if payment for the property to be sold is taken in shares instead of in cash, but as the shares are usually sold, it is the same thing to the vender, and he gets credit for confidence in the enterprise at no expense. In fact, many promoters prefer their claims to be paid in shares, as they expected to sell them at a premium.

A promoter whose scheme failed to float and was thoroughly exposed in the financial papers, soon after started another company. A friend said to him, "Do you think anything with your name on it would go, after this last failure." "Oh, that doesn't matter," said the promoter, "there's a new fool born every minute."

Although Carlyle said the people of England were "mostly fools," it is not the fools who mainly support these things. They have been again and again exposed in papers and magazines, and a wide distrust prevails. The popular sentiment is shown by one of the "gags" of the theatre; an actress wishes to describe a mendacious person and exclaims, "He is like the prospectus of a limited company." As has been remarked, the investments of this class are mainly supported by the speculators who only consider whether the shares will advance in the market, and pay a little head to the lasting merits of the enterprise.

There has been lately a great movement towards turning industrial enterprises, manufacturing businesses and trading concerns into limited companies. This is a good way of preserving a profitable business when its proprietor becomes incapacitated, and is in accord with the spirit of the age which favors co-operation and a wider distribution of profits. But, doubtless, many rotten concerns have by this means been unloaded upon the public.

One gets the impression while moving in financial circles in London that gambling has become a recognized business, and that any means taken to promote such a cause are legitimate. Pious, devout men are engaged in these schemes, and men who will not hesitate to "support the market" and bid up their own shares will refuse to advertise in a Sunday newspaper.

All this business clusters about the vicinity of the Royal Exchange, which bears the inscription on its portico, "The earth is the Lord's, and the fullness thereof."

Increasing Demand for Plumbago.—

Few articles which enter largely into mechanical processes have, of late years, received more extension of their use than has plumbago. Until comparatively recently its employment was mainly confined to the manufacture of crucibles, while outside of these the imports of it by the United Kingdom were principally devoted to the manufacture of inferior lead pencils, and of what was nominally termed blacklead compounds for domestic stove cleaning etc. But of late years other qualities have been discovered to be possessed by this mineral, which has largely widened the sphere of its employment. It is as a lubricant that its high qualifications are now generally admitted, and its use in that character has greatly tended to increase its use; so greatly so, indeed, that whereas some years back its price ruled so low as £7 10s. the ton, contracts for its supply are now made at £20 the ton on board ship at the ports of export.

Gold Milling in the Black Hills.

(H. O. Hoffman, Rapid City, Dakota.)

(Continued from December issue.)

Those that are still good (dies last six weeks) are returned to the mortar without further cleaning. After the dies have been taken out the remaining sand is shovelled out and piled up in a convenient place in the mill to be treated separately in the rocker and the pan (see later.) It is rich in amalgam and contains pieces of iron that have accumulated in the mortar. Any particles of amalgam that have adhered to the rough sides of the mortar are removed and added to the sands. The dies are now put in place again. If new shoes are required they are placed on top of the dies, with the wooden collar slipped over the shank. Then the recesses for the chuck-block, screen-frame, etc., are cleaned by directing a hose upon them, and these are put in place, the screens having first been cleaned in a wooden box with brush and water. When the chuck-block is in place, the sands first removed are shovelled in to fill the bottom of the mortar up to the top of the dies. The drop of the stamp has now to be regulated. If new shoes are used, the wooden block, 1 inch higher than the drop, is placed on the shoulder of the shoe and the stamp let down until the head rests on the block. If the shoe has not been replaced, the block stands upon the die. In both cases the keys of the tappets are loosened, these are allowed to fall on to the prop and are then keyed up again. The apron-plates are now dressed in the usual way. Any amalgam adhering to the small sluices, leading to the mercury-traps, and to the sluice-boxes is removed and these are brightened in the same manner as the apron-plate. When the engine has been started up, the stamps that have new shoes are first allowed to drop several times until the sound and the vibration, felt when touching the tappet, show that the shoe is thoroughly fastened to the head. The splash-boards are put back in place, some ore is fed into the mortar, the water is turned on and the stamps of one battery after another are let down from the props. Special care has to be taken by the feeders to regulate the ore supply, as the mortars are empty above the dies when the mill starts up.

In cleaning up a mill, all the hands have to take part, the night shift working six hours extra.

This detailed description of the clean up of a 120-stamp mill has been given, because it seemed important to show how it is possible to accomplish it in the short space of seven hours without requiring any outside help. When it is remembered that more than a day was formerly consumed in this work, it will be seen how admirably the operations are now systematized and worked one into another.

When the clean-up of the mill is over and the stamps are once more in operation, the sands that were shovelled out from the bottom of the mortar have to be worked up and the amalgam has to be cleaned, so as to be ready for the retort. Two crush-men are detailed to clean up the sands. These contain bits of iron that have come from the tools used in the mine or the crushing machinery of the mill, and also pieces of amalgam. The sands are first treated in a rocker. Any coarse pieces of iron are picked up and collected in a separate heap. When the sands have been rocked for a little while and the hose has been played on them, the residue on the hopper is broken as fine as possible with a wooden mallet. The products obtained by rocking are the coarse particles remaining

finally in the hopper. These are washed in a coarse screen over the clean-up pan, and any amalgam remaining on the screen is picked out and thrown into the pan. The sands go back to the battery. The heavy sands that collect on the curtain and riffle are taken up in a bucket to be worked in the pan. Those settling in the sluice which conducts the slimes to the waste flume are shovelled out and returned to the battery.

There remains the purifying of the amalgam collected from the chuck-blocks, apron-plates, sluices leading from the mercury traps, mortars, old shoes, dies and screens. It is charged with water into the clean-up pan (5 ft. in diameter, the muller making 30 revolutions per minute) and from 600 to 700 lbs. of quicksilver are added. It takes about three hours to clean in the pan all the by-products that contain any amalgam. When this is all collected and the water above it is somewhat clear, the muller is raised with block and tackle and the entire contents of the pan are emptied through the lowest discharge-opening into a square box which overflows into the tailings-discharge box. The muller and bottom of pan are cleaned with brush and water. The liquid amalgam in the first box is now freed from water and passed through a strainer. The resulting pasty amalgam is removed, and freed from the excess of quicksilver by wringing it in canvas bags in water. The balls of hard amalgam remaining in the bags contain about 38 per cent. of gold. The quicksilver collected beneath the strainer goes back to the main stock; that obtained by squeezing the pasty amalgam is first verified by adding some nitric acid, stirring it, and then washing it with water.

The clean-up on the fifteenth of the month is much simpler than that on the first, as only the chuck-blocks are taken out and the mortar is left intact, except, of course, when any break has occurred in shoe or die. On the fifteenth, however, the mercury-traps are cleaned. Their contents go simply into the pan and are worked with the rest of the products containing amalgam. This clean-up lasts five hours—that is, two hours less than the one on the first of the month.

The cleaning up of old iron and wood chips, which is done once a year, stills remains to be mentioned in this connection. The pieces of iron that are picked out from the sands in the bottom of the mortar are first scraped, to remove any amalgam adhering to them. They are then thrown out upon an enclosed heap in the yard and left there to be corroded by atmospheric action. The rusting is hastened by adding some salt to the heap at various times. Once a year, the iron that has entirely fallen to pieces is charged with quicksilver into the pan and its gold extracted. The chips of wood, which float on the top of the water in the battery and often clog the screens, are repeatedly removed and collected in a box in one of the window recesses. They are then emptied on a heap in the yard, and once a year are set on fire. The ashes are collected and amalgamated in the pan. In this way are saved every year from 16 to 18 pounds of amalgam from the two mills of the Homestake Company (200 stamps).

Retorting and Melting.—The quicksilver still retained by the hard amalgam is removed by retorting. Both bulb retorts and cylindrical ones are used. They are all of cast iron. The cylindrical retort of the Homestake Company is 12 in. in diameter and 3 ft. long, and holds about 1,000 lbs. of amalgam. The usual charge of 500 lbs. is retorted in about 6 hours with $\frac{1}{4}$ cord of wood. The loss of quicksilver is nominal.

The retort-metal amounts to 38 to 40 per cent. of the original charge. At the Caledonia mill it is only 33 per cent., less care being taken in cleaning the amalgam; and at the Deadwood-Terra mills it is often only 25 per cent., by reason of the fine condition of the gold, which requires more quicksilver to form amalgam.

The retort-metal is now melted into bars. At the Homestake mill, two kinds of moulds are used, the 1500-ounce silver mould, 5 by 5 by 11½ inches, and the 700-ounce mould, 3½ by 4 by 9½ inches. The bars are cast from 3 to 4 inches thick and weigh from 1000 to 1400 ounces. It takes about four hours to melt four 1400-ounce bars and the crucible lasts for from eight to twelve charges.

The loss in melting with Homestake retorted bullion is only 1.5 per cent. and the average composition of the bars is 820 gold, 165 silver, 15 base metal. The loss of the Caledonia bullion is greater (7 per cent.), as less care is taken in cleaning the amalgam. The average composition of its bullion is 798 gold, 182 silver and 20 base metal.

The bullion is sampled, weighed, assayed and shipped.

VII. WORKING-RESULTS

The Homestake and Golden Star mills together produced, according to the report of the Homestake Company, from June, 1887, to June, 1888, \$895,822.37 worth of gold from 243,355 tons of ore, which corresponds to a yield in free gold of \$3.68 per ton. It is claimed that 85 per cent. of the free gold is saved. According to this the ore would run in free gold \$4.33 per ton. The total value of the ore varies from \$5 to \$10 per ton; the amount of concentrates in the pan, is \$24 per ton, although judging from the average assay of the tailings, (\$1.50 per ton) a much higher figure would be expected.

Two sets of experiments were made in the spring of 1885 by Dr. R. Goering on the Homestake and Golden Star tailings, the first when the mills had no mercury-traps, the second after these were introduced. Up to that time there had been collected by means of blankets in a separate building (the blanket house) 1124 tons of concentrates which assayed \$35.16 per ton. These, panned down, gave 20.5 per cent cleaner concentrates, assaying \$40.18 per ton. When amalgamated in the pan they yield 55.9 per cent. of their total value, the remaining pure pyrites assaying \$17.08 per ton. This shows that the gold recovered must have been either enclosed in quartz or rusty, or that amalgam had been carried off with the tailings and was recovered by the blankets. When in consequence of these tests the mercury traps were introduced, the loss was reduced. The concentrates then saved assayed \$27.63 per ton. They gave up 92 per cent. of their gold in the pan, but the pure pyrites still assayed \$12.26 per ton, showing that while the loss had been diminished, it had not been stopped. The concentration of tailings by blankets, being too expensive, was given up.

From the other mills under the Homestake management no official reports are made public; therefore no data can be given. It may, however, be stated that the tailings from Highland ore average \$1 per ton, those from Deadwood-Terra ore \$0.50 per ton, and seldom exceed \$0.75. It would be interesting to find how small the amount of concentrates is and how high these would run.

One point still remains to be considered in regard to working-results, that is the fineness to which it is necessary to crush the ore. Dr. R. Goering made tests to find a relation between size and assay value of tailings. Samples were

taken hourly for a length of time and the sands obtained dried, weighed and screened through different sieves. The figures are given below:

TABLE VI.—*Reduction between Size and Assay-Value.*

Per cent in weight.	Passing through screens, No.	Remain-ing on screens, No.	Assay value per ton.
94.07	50	..	\$1.24
2.53	50	40	2.13
3.40	50	..	2.79

They show that the loss in the tailing increases rapidly, if the screens are allowed to remain too long in the mortar. This is still better shown by another series of experiments (December, 1888) on tailings, running \$2 per ton, that were screened through a No. 30 mesh sieve. Of these, 6 per cent., that did not pass through the screen, assayed as high as \$5.02 per ton. The result is, as has been said before, that the heavy Russian-iron slot screens have to be exchanged every fortnight.

The Caledonia mill crushed, from May, 1887, to May, 1888, 73,425 tons of rock and produced \$295,816.25 worth of bullion, equalling a yield of \$4.02 per ton in free gold. Figures corresponding to those given in the Homestake Company could not be obtained. It may, however, be stated that the blanket concentrates of the Caledonia, amalgamated raw in the pan, yield a product of pure pyrites, assaying \$90 to the ton, and that the tailings from the blankets, when panned, yield concentrates worth from \$7 to \$9 to the ton.

TABLE VII.—*Cost of Milling in 1887-88 at Homestake and Golden Star Mills.*

Items.	Homestake Mill. (96,790 tons treated.)		Golden Star Mill. (146,565 tons treated)	
	Amount expended.	Cost per ton.	Amount expended.	Cost per ton.
Labor.....	\$24,789 90	\$0.2561	\$31,338 60	\$0.2138
Supplies....	1,263 71	0.0130	1,149 65	0.0079
Water.....	16,731 37	0.1729	25,097 10	0.1712
Wood.....	26,773 50	0.2766	40,156 50	0.2739
Machinery..	8,924 06	0.0922	17,884 96	0.1220
Oil.....	1,052 69	0.0109	1,233 21	0.0084
Candles....	156 00	0.0016	214 50	0.0014
Quicksilver..	1,001 25	0.0103	3,701 05	0.0252
Lumber....	684 06	0.0070	799 16	0.0054
Total....	\$81,376 54	\$0.8406	\$121,574.73	\$0.8292

In comparing the cost of milling in the 80 and the 120-stamp mills, it seems strange that there should be so little difference. Special causes must have affected this year's work, for the cost per ton in 1880* was \$1.3018 and \$0.7770 respectively.

The cost of milling at the Caledonia mill for 1887-88 was \$8.87 per ton, ⅓ going to labor and ⅔ to material. This is a low figure, if we consider that the mill has only 60 stamps and that the ore treated is very hard in comparison with any Homestake rock.

VIII. CONCLUSIONS.

Two striking features are presented by the foregoing review; the simplicity and effectiveness of the methods by which the free gold is extracted; and the evident waste of sulphurets in the tailings. These sulphurets appear, according to the figures given above (3 per cent., assay-

ing \$24 per ton), to be quite rich enough to repay working.

A simple and cheap method of concentration, for the large quantities to be treated, would probably be as follows: The pulp, after passing over a series of spitzluten, which would sort out the coarse sands, would overflow into a series of spitzkasten, and the overflow of these would be waste. The coarse sands, sorted out by the spitzluten, would contain, according to experiments made in 1885 on the large heap of concentrates, free gold, which would be recovered by crushing them wet in rolls or a Chilian mill, allowing the pulp to flow over amalgamated plates, and then pass over a separate series of classifiers or else go back to the main system. The graded pulp, obtained by the different spitzkasten, would be separated on continuous round tables, into pure concentrates, middlings, and waste.

The middlings would be worked separately, or be pumped back to the main system of spitzkasten. The cost of concentrating the tailings would probably not exceed \$1 per ton of sulphurets.

The method of working these concentrates would be that of barrel-chlorination, using bleaching powder and sulphuric acid to generate the chlorine. In a paper read before the Institute at the Buffalo meeting, October, 1888, Prof. William B. Phillips says the cost of dead-roasting on a 12-ft. revolving hearth, at the Phoenix mines, North Carolina, is \$2.03 and \$2.18 per ton. A combination of two systems of furnaces would probably accomplish this dead-roasting at a proportionately cheaper rate at the mills, where wood is \$6 a cord and labor \$3 and \$3.50 a day. The Spense automatic desulphurizing roaster would do the preliminary roasting cheaply, and the revolving hearth would effectually dead-roast large quantities of ore, whose sulphur had been nearly all eliminated. Prof. Phillips further gives the cost of chlorinating at \$2.66 per ton of concentrates. This figure would have to be considerably increased for the Homestake and other mills. The total cost would probably be not over \$8 for the ton of concentrates.

In closing this paper, the writer desires to express his thanks to the management of the Homestake and Caledonia mills for their courtesy in allowing him the run of the works and to Dr. R. Goering for his valuable assistance in obtaining detailed information. Also to Messrs. R. Graham and Chas. Ruth, for their uniform kindness in answering questions.

THE BELL TELEPHONE CO. OF CANADA.

ANDREW ROBERTSON, PRESIDENT
C. F. SISE, VICE-PRESIDENT
C. P. SCLATER, SECRETARY-TREASURER

HEAD OFFICE, - MONTREAL.

H. C. BAKER, Manager Ontario Department,
HAMILTON.

This Company will sell its instruments at prices ranging from \$10 to \$25 per set. These instruments are under the protection of the Company's patents, and purchasers are therefore entirely free from risk of litigation.

This Company will arrange to connect places not having telegraphic facilities with the nearest telegraph office, or it will build private lines for firms or individuals, connecting their places of business or residences. It is also prepared to manufacture all kinds of electrical apparatus.

Full particulars can be obtained at the Company's offices at above, or at St. John, N.B., Halifax, N.S., Winnipeg, Man., Victoria, B.C.

*Tenth Census of the United States, vol. xiii., p. 280.

Florida Phosphates.

Mr. W. P. Frost, Savannah, Ga., sends us the following, which we have pleasure in reproducing:

As Florida phosphates seem to be exciting a great deal of interest all over the country among fertilizer manufacturers and dealers, more especially in Charleston, where it is, of course, a matter of vital importance, and as there seems to be a dearth of accurate and intelligent information on the subject, a few remarks by one who professes to be an expert on such subjects, and who spent a month in Florida this summer looking up this matter, may be interesting to your readers.

No geological survey has ever been made of Florida, it being regarded as a "sand bank and a coral reef," and for this reason the value of her phosphate and other mineral deposits have been overlooked. Now that the present boom has been inaugurated, however, we may look for the development of some very valuable finds, not only in phosphates, but in other minerals, such as natural cement, gypsum, etc.

Fossil bones and phosphates, mostly low grade, are found nearly over the entire State, but in too small quantities to work. As is naturally to be expected, the former being more recent than in South Carolina, remains are in a better state of preservation, and some few handsome specimens are to be found. In the Sub-Tropical Exposition at Jacksonville is to be seen a magnificent specimen of the skull of a mastodon, wonderfully well preserved and with tusks five or six feet long. Numerous valuable fossils have been sent to Washington. The fossil remains found consist principally of the ribs of the manatee or sea cow, which are also found, though not so abundantly, in South Carolina. It is a curious coincidence that all the phosphate deposits so far discovered are on the Gulf coast. Nothing has been found on the Atlantic side of the peninsula. On the South Atlantic shore, however, which is very undeveloped, a better acquaintance may result in something.

Beginning on the Gulf coast, then, in the extreme northwestern corner of the little spur that runs out from the peninsula proper, we find the Sopchoppy Phosphate Company organized, and working in a desultory way a deposit in Wakulla County. Following the trend of the coast southwards, we come to the Savannee River, at the shoulder of the peninsula proper, which has furnished most of the fossil remains found, and which is said to literally bristle with them.

Coming southwards, we next strike the Withlacoochee River, on whose banks, about eighteen miles from the Gulf, the great phosphate deposit of Florida, and perhaps of the world, has been discovered. The next deposit of phosphate we hear of is in the Alafia River, a small tributary of Hillsborough Bay, near Tampa. On the southern shore of the mouth of Tampa Bay, on Tenaceia Island, and on the adjacent mainland, we find phosphates, which are also reported a short distance away in the Manatee River. Running our finger further south along the map we enter Charlotte's harbor, at the head of which enters Peace River, and at another point the Myakka River, on both of which there are phosphate deposits, but more especially on the first.

Up to September last these included all the known deposits of phosphates in Florida, although there were indistinct rumors of a valuable find on the South Atlantic coast, which, however, does not seem to have materialized.

Any one who has followed this description, with a map before him, will see that the whole Gulf coast is a phosphate bed. Fortunately, however, for our Carolina phosphate magnates, the majority of these deposits are of little or no value. The Sopchoppy deposit consists principally of a low grade phosphatic sandstone, mixed with a considerable percentage of fossil bones, which bring up the average analysis to something like 40 per cent. of phosphate of lime. It is not regarded as very valuable, although it might pay to separate the bones, which analyse about 70 to 75 per cent.

The Suwannee River deposits are not extensive enough to be worked profitably and are interesting from a scientific and geological standpoint only.

The next deposits are situated on the Withlacoochee river, about eighteen miles from the Gulf, near Dunnellon, a small place on the Silver Springs, Ocala and Gulf Railroad, a branch of the Florida Central and Peninsular, or the old Florida Railway and Navigation Company, which runs from Fernandina as far south as Orlando, with numerous branches. The deposit is owned by the Dunnellon Phosphate Company (lately organized), of which Mr. Geo. F. Dunn, of Ocala, is the president and principal stockholder. They own, altogether, about thirteen thousand acres of land, which was all selected by a prospecting party, who had a chemist along with them, and who purchased only where they saw phosphate indications. The company is capitalized at a million and a quarter dollars, two hundred and fifty thousand dollars of stock being for sale.

In order to understand the formation of the deposit, it is necessary to state that considerable tracts in Florida are underlaid by solid beds of carbonate of lime, which is still in a soft state, a little harder and more crystalline than our marl. This begins at varying depths from the surface, (sometimes only one or two feet), and continues down to great depths. The surface indications of this deposit are large slabs of flint, which occur in veins in the carbonate, and are left on the surface after the latter has been dissolved away and soil formed in its place by the gradual process of nature. The formation of the Dunnellon phosphate beds corresponds exactly with this carbonate formation, which leads to the theory that they were probably formed by the leaching away of the carbonate and the gradual deposition of phosphate of lime in its place. The surface indications in this case are (usually) a hard, dense, stratified, white rock, which analyses as high as the equivalent of 75 to 80 per cent. of bone phosphate of lime, and will average about 70 per cent. This is disseminated through the surface soil in varying quantities, where it is found, but by no means constitutes the bulk or the most valuable part of the deposit. Beneath this, at depths varying from one to five or six feet, is found a material varying in color from pure white to a dark, creamy yellow, and having nearly the same consistency as our South Carolina marl. I myself have seen an angler bored down sixteen feet into this stuff without getting through it. To this depth it remained of the same mechanical consistency throughout, perfectly smooth and free from grit. In other words it was a solid bank of phosphate (16) feet thick, to my certain knowledge. How much thicker I do not know, but "Crackers," (*i. e.* natives,) who were ignorant men and did not know the value of the material, (as evidenced by the fact that their lands were being bought from them every day for a song,) testified that they had seen wells dug in

this material, before getting through it to a water-bearing strata, to a depth of sixty feet. I do not mean to say that this deposit covers the whole tract which the company owns. It occurs in pockets, and runs in ridges parallel to the old shore lines and to the Apalachian range—*i. e.*, northeasterly and southwesterly. From my limited knowledge of the deposit, however, and the fact that all the land was, as I say, carefully and intelligently selected, I should regard, as a safe and conservative estimate, that it occurs on one-fourth of the thirteen thousand acres. However, as I was only on the ground for one week, my opinion on this point may not be reliable. I have not seen an analysis of it which ran below 50 per cent. of phosphate of lime. Several made by myself and other chemists ran 60 to 65 per cent. The average would be probably 55 to 60. It contains a trace of carbonate—no fluorine—a very small percentage of sand, about half per cent. of potash, 40 per cent. of lime, and 10 to 15 per cent. of iron and alumina. This latter is very injurious, ordinarily causing the soluble phosphoric acid in the acid-treated material to revert, (which in England is a very serious matter,) and also preventing it from drying out, another very serious objection here and elsewhere. But from experience gained in treating several samples of this material with acid I have come to the following conclusions: First, that the acid-treated material will dry out, especially when made from the marly or clayey deposit, which combines with the acid with great avidity, soaking it up and getting very hot without getting liquid at all. This is with the sun-dried material, and using such proportions of acid and phosphate as are usually used with Carolina rock. The rock deposit does not dry out so well when treated with acid, and might not be profitably used, as it takes a long time to dry, and then sets into a hard mass. Second, neither does the large percentage of iron and alumina cause the soluble phosphoric acid to revert, as I have analyzed samples of the acid phosphate two months after it was made, which contained an unusual percentage of soluble as compared to reverted phosphoric acid. I can only account for these injurious constituents not acting in their usual way by supposing that the presence of so much lime counteracts their presence. Third, this material yields a larger per centage of "available" when treated with acid than Carolina rock does. One specimen of acid phosphate, made in the proportion of one thousand pounds of 50° B. acid to twelve hundred of the sun-dried marly deposit, and analyzed two months after it was made, yielded 17 per cent. of "available," (of which 14 per cent. was soluble,) with 2½ per cent. insoluble. Another sample by a similar formula yielded two days after it was made 18 per cent. of available, with 2 7-10 per cent. of insoluble.

The mining and preparation for market of this material would be a simple and inexpensive process, as it occurs exactly like a clay bank—a solid bed of soft material—which would simply have to be shovelled up and brought to the surface. It would then have to be dried either by the sun or artificially on the large scale, probably by means of steam-heated cylinders, such as are used in Chicago establishments to dry tankage, etc. This would finish its preparation as far as the miners are concerned. The final process, the grinding, would interest the manufacturer and might give ours some trouble at first, as, although the material is perfectly soft and friable and contains very few lumps, it is perfectly "dead" when struck, and

the fine particles have no "slickness" about them. For this reason it would probably clog a Lucop mill or buhr-stone unless it was very dry. However, simply passing the very dry stuff through rollers might be sufficient, as it is in such a fine state of subdivision naturally, and soaks up acid so readily. The principal difficulty in mining would be drainage, as a portion of the deposit is in very low land, and in going down to such depths it would be necessary to have steam pumps and conduits for the waste water to the river. Taking all this into consideration, however, it could be mined for a great deal less than Carolina rock, because in the first place when a cubic yard was thrown out, it would be a cubic yard of pure phosphate, whereas in Carolina this constitutes but a comparatively small percentage. Secondly, the actual cost of getting down to the material would be nothing like so great, as not one-hundredth part of the surface earth would have to be thrown off in proportion to the phosphate mined. The drainage would probably not be more than on some of our lands. The drying should not cost more. There would be no washing. And, lastly, the grinding and crushing, after we learned how to do it, would have to be very much less.

As to transportation facilities, it would probably have to be shipped to Fernandina, which is a deep water port, one hundred and eighty-two miles distant. Or it might be lightered down the Withlacoochee River to the Gulf, but as the whole Gulf coast is very shoaly it would probably only be practicable for sailing vessels to get up to the mouth.

Of the other deposits in Florida, that on the Alafia River is being worked by an Atlanta company. There seems to be some doubt about its value, however, and I suspect that it is in too small quantities. Those on Tenaceia Island and the adjacent mainland consist of low

grade sandstone and fossil bones, and are not in sufficient quantity to warrant mining.

The deposits around Charlotte's Harbor appear to be very valuable. Geo. W. Scott, of Atlanta, with whom are associated several New York parties, own between five and six thousand acres of selected phosphate land, which was bought for very little, before the presence of phosphates was suspected. The company has been involved in a law suit from its formation, and an injunction served on Mr. Scott by one of the partners has prevented any work being done. Now, however, the objectionable partner has lately been bought out for a round sum (considering that he only owned a one-sixth interest), and we may expect developments on an extensive scale very shortly. All the mining that has so far been done in this locality has been done by a man named Morehead, who only owns some two hundred acres in the centre of Col. Scott's tract. All of it has been shipped by rail to Atlanta, and used by the Geo. W. Scott Manufacturing Company, who, from all accounts, are well pleased with it. Some of it runs very high, and all that I have ever seen runs over 60 per cent. It resembles Carolina rock more than any Florida phosphate, perhaps, but is in very much smaller nodules, and has a considerable portion of fossil bone in it.

The deposits on the Myakka River do not seem to be so valuable as those on the Peace River. From all I can hear there seems to be some good land to be bought in this section, however; i.e., on the Peace and Myakka rivers and Charlotte's Harbor.

Air-Compressing Machinery at Collieries.—Mr. J. Morison points out the danger attending the use of light material oils for

lubricating air-compressing machinery. On February 13, 1888, he examined at Newbattle Colliery Dalkreith, the discharge pipes leading from an air-compressor to a receiver 50 feet away. The pipes were of cast iron, 6 inches inside diameter, and had flanged joints, the joints being made with india-rubber insertion screwed up between the flanges. The compressing cylinder was 24 inches in diameter by 4 feet stroke, and air was compressed up to 50 lbs. per square inch. The cylinder was fixed in a tank containing water, but no other method was used for cooling the air during compression. The temperature of the air leaving the compressor was found to vary between 320° and 375° F. when compressed up to 50 lbs. per square inch. The receiver was blown off daily. Some little time previously the pipes leading to the receiver appeared to be unusually hot, and soon two of the pipe joints between the cylinder and the receiver began to blow, while sparks were blowing with the air out of the joint, and the pipe was nearly red hot. On taking out the joints, they were found to be charred and burnt through, and the interior of the pipes was coated with a charred deposit, doubtless the residue of the combustion of lubricating oil which had been used in the cylinder. The oil ordinarily used was lard oil, but owing to a temporary want of this latter, for a short time previously use had been made of a mixture of heavy mineral oil (high flash-point) with an oil bought as colza. The supposed colza oil was chiefly made up of thickened cotton-seed oil and intermediate mineral; its specific gravity was 0.91, and it had a strong mineral bloom, and flashed at 295° F. The author compared the circumstances of the two cases, and concluded that the flash-point of all oil used in air-compressing machines should be tested, or a guarantee should be obtained from the maker.

CHEMICAL APPARATUS!

OF EVERY DESCRIPTION.



Glass, Porcelain, Stoneware, Platinum Crucibles of every sort, Analytical Scales and Weights, Fine Chemicals and Reagents, including Volumetric Solutions. Every requisite for Analysis or Experiment. For Sale by

LYMAN, SONS & CO.,
384 St. Paul St., Montreal.

Illustrated Catalogue mailed on receipt of 10c. or Business Card.



MONEY ORDERS.

MONEY ORDERS may be obtained at any Money Order Office in Canada, payable in the Dominion and Newfoundland; also in the United States, the United Kingdom, France, Germany, Austria, Hungary, Italy, Belgium, Switzerland, Portugal, Sweden, Norway, Denmark, the Netherlands, India, Japan, the Australian Colonies, and other countries and British Colonies generally.

On Money Orders payable within Canada the commission is as follows:

If not exceeding \$4	2c.
Over \$4, not exceeding \$10	5c.
" 10, " "	10c.
" 20, " "	20c.
" 40, " "	30c.
" 60, " "	40c.
" 80, " "	50c.

On Money Orders payable abroad the commission is:

If not exceeding \$10	10c.
Over \$10, not exceeding \$20	20c.
" 20, " "	30c.
" 30, " "	40c.
" 40, " "	50c.

For further information see OFFICIAL POSTAL GUIDE.

Post Office Department, Ottawa.
1st November, 1889.

Dr. FRANCIS WYATT.
SPECIALTIES:
Sulphuric Acid, Pyrites,
And PHOSPHATES.
24 PARK PLACE,
NEW YORK.

ASSAYERS' SUPPLIES,

Chemicals and Chemical Apparatus.

BEST GOODS, LOW PRICES, PROMPT SHIPMENT,
CAREFUL PACKING.

RICHARDS & COMPANY,
41 Barclay St., New York.

Agents for BECKERS SONS' Balances and Weights of Precision, of Rotterdam, Holland.

SPECIALIST IN MICA

MINER'S AGENT

RICHARD BAKER,

6 & 7 Cross Lane, - London, Eng.

JAMES C. ASHTON,

Mining and Mechanical Engineer

Experience in the gold-fields of the Transvaal, South Africa, and of Nova Scotia. Mines examined and reports furnished thereon. Advice and estimates given for the development of mines. The smelter at Revelstoke is in full operation, and assured steam-boat and railway communication will bring about great activity in mining next year throughout the rich Kootenay Valley.

Agent in Canada for the Newberry-Vautin (Patents) Gold Extraction Company (Limited). London, England. Address,

Box V, Vancouver, British Columbia.

SOCIÉTÉ

Canadienne d'étude Minieres

CAPITAL, - - \$100,000

Assaying, Prospecting and Mining.

HEAD OFFICE, - - - 30 St. FRANCOIS XAVIER ST.
P. O. Box 1625, MONTREAL.

Office in Paris (France) 12 Place Vendome.

DIRECTORATE:

M. SCHWOB, Vice-Consul of France, President.
JOHN S. HALL, Q.C., M.P.P., Vice-President.
C. A. DUGAS, Judge of Sessions }
C. H. A. GRANT, Directors.
C. DUQUET, Alderman, Quebec, }
G. WERNER, Secretary and Treasurer.
L. DE LA VALLEE POUSSIN, I.C.P. }
JOHN D. FROSSARD, M.E. } Consulting Engineers.
JOHN S. HALL, Q.C., M.P.P., Advocate, Legal Adviser of the E.L.

ALEX. RANKIN,

20 Toronto Street, Toronto Ont.

Agent for sale of Mines and Mineral Lands

CORRESPONDENCE SOLICITED.

Agents in England and New York.

MINERS OF NOVA SCOTIA!

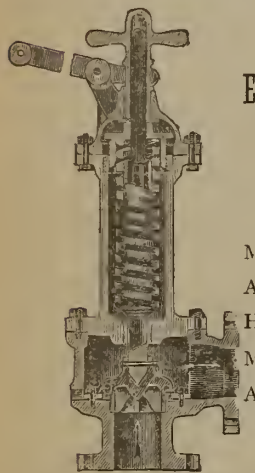
W. & A. MOIR,

MECHANICAL

Engineers and Machinists,
HALIFAX.

Manufacturers of

Mill and Mining Machinery,
Air and Circulating Pumps,
Hand and Power Elevators,
Marine & Stationery Engines
And Brass and Iron Castings
of every description.



BURN, NORRIE & CO.,

Locators of Precious Metals

— AND —

DEALERS IN MINERAL LANDS,
COBOURG, ONT.

W. D. BURN. P. O. BOX 198. DAVID NORRIE.

LEDOUX & COMPANY,

10 CEDAR ST., NEW YORK.

Engineers, Metallurgists &
Assayers.

Public Ore Sampling & Storage Works

All the principal buyers of furnace materials in the world purchase and pay cash against our certificates of assay, through New York banks.

By special permission of the Secretary of the Treasury of the United States, cars of ore or copper matte passing through in bond can be opened and sampled at our works.

Consignments received and sold to highest bidder. Send for circular giving full particulars.

Mines examined and sampled. Assays and Analyses of all kinds.

Morgan Crucible Co.

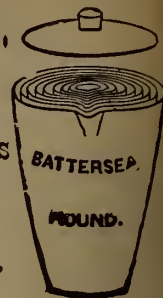
BATTERSEA, ENGLAND,

Manufacturers of

Crucibles, Furnaces, Muffles
AND SCORIFIERS

Of superior quality.

LEONARD RICHARDS, Agent,
41 Barclay St., New York.



Established 1831.

EIMER & AMEND

Importers and Manufacturers of Chem-
icals, Chemical Apparatus and

Assay Goods,

205, 207, 209 and 211 Third Ave.,
NEW YORK.

SPECIALTIES:

**BALANCES, WEIGHTS,
PLATINUM,**

Absolutely pure Chemicals and
Acids, Royal Berlin and Meissen Porcel-
lain, Kavalier's Bohemian Glass.



J. S. HOSSACK, President.

C. ANDERSON, Secretary-Treasurer.

T. J. CARROLL, General Manager.

HAMILTON BRASS MFG. CO.,

MANUFACTURERS OF

Engineers' and Plumbers' Brass Goods,

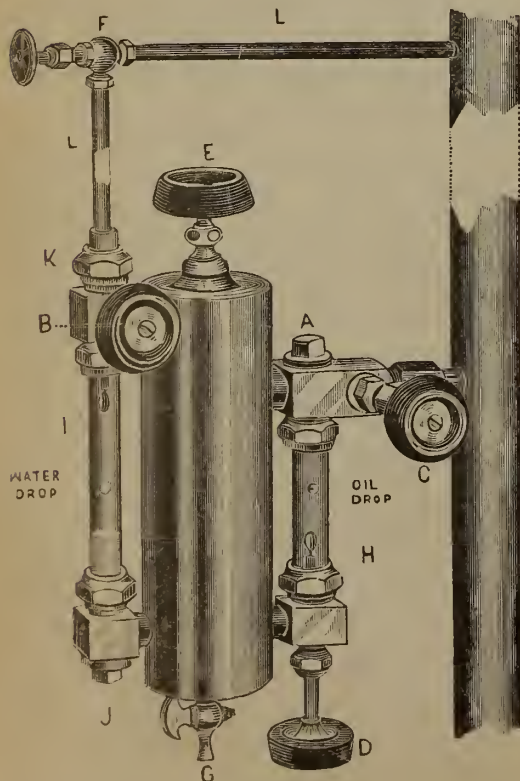
BRASS TUBING AND ALL KINDS OF BRASS CASTINGS.

259 & 261 James Street N.,

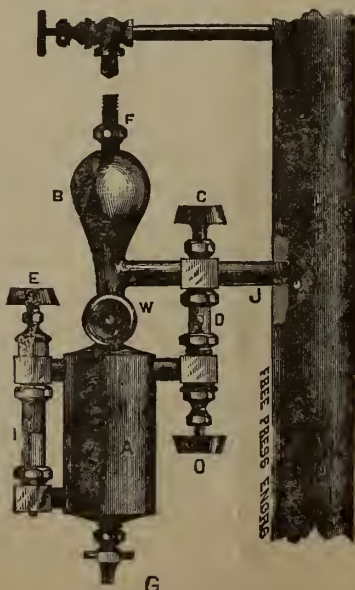
HAMILTON, ONT.

REDUCED PRICES.

1 Pint.....	Plain, Brass \$4 50	Nickel Plated, \$5 00
1 Pint.....	" " 5 00	" " 6 00
1 Pint.....	" " 8 00	" " 9 00
1 Quart	" " 11 00	" " 12 00
2 Quarts.....	" " 16 00	" " 18 00



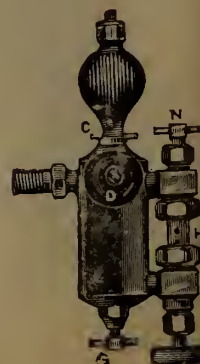
EAGLE.



MICHIGAN.



DETROIT.



The Canadian Mining Review

CONDUCTED BY E. T. A. BELL

OFFICES:

UNION CHAMBERS, 14 METCALFE ST.,
OTTAWA.

THE OFFICIAL ORGAN
Of the Gold Miners' Association of Nova
Scotia, the Canadian Phosphate, Asbes-
tos, Coal, Silver and other Mining
Interests.

PUBLISHED ON THE 25th OF EACH MONTH.

SUBSCRIPTION RATES.

ONE YEAR (in advance)	\$1.50
SIX MONTHS	1.00
SINGLE COPY .....	.15
BRITISH AND EUROPEAN (post paid)	1.75

ADVERTISING RATES.

SPACE.	ONE MONTH.	THREE MONTHS.	SIX MONTHS.	TWELVE MONTHS.
One Page.....	\$30.00	\$70.00	\$130.00	\$250.00
One-Half Page...	20.00	40.00	70.00	130.00
One-quarter Page..	10.00	25.00	40.00	75.00
One-Eighth Page..	8.00	15.00	25.00	40.00

Professional and Business Cards.

Advertisements under this head inserted at the rate of \$15.00 per year per inch.

Want Column.

Fifteen cents per line; no advertisement to occupy less than two lines. Orders for this column, and for all transient advertisements, must be accompanied by cash.

Remittances.

Remittances should always be made by Bank Drafts, Cheques or Post Office Orders, made payable to the Manager. American Postage Stamps are of no use to us whatever, and will not be accepted in payment of small amounts.

Co-Operation Invited.

The publishers earnestly request the co-operation of readers of the REVIEW for information, communications that can be utilized, suggestions, news items, etc., etc. All such should be addressed to the Editor.

Vol. IX. FEBRUARY, 1890. No. 2.

Florida Phosphates.

Much excitement has been caused in the fertilizer world by the report of the discovery of large deposits of high grade phosphate in Florida. It has been known for a long time that there were deposits there somewhat similar in nature to the Carolina phosphates, but generally consisting of smaller sized nodules, and in some cases of lower quality. Dr. Penrose in his monograph on "The Nature and Origin of Deposits of Phosphate of Lime," which was published last year by the U. S. Geological Survey, gives the result of his personal examination of these beds, but describes them as being "either of too small extent or of too poor quality to pay for mining." He says, "the phosphate found here (in Alachua County, near the central part of the State) belongs to the subdivision of phosphatic conglomerates. The rock consists of small pebbles, from the size of a mustard seed to that of a pea, closely packed in a matrix of indurated calcareous marl." The pebbles averaged 85 per cent. of phosphate of lime, while the whole mass of the rock gave about 48 per cent.

In localities on the west coast of Florida, phosphate resembling that of Carolina was dredged from the rivers, and averaged about 55 per cent. in quality. None of these deposits were deemed to be of any particular commer-

cial value at present, and not much attention was paid to them. But in the spring of 1889 Mr. Albertus Vogt who lives near the village of Dunnellon, in boring for a well found fossil sharks teeth in a whitish soil, which when analyzed by a chemist, proved to be phosphate of lime of high quality. This soil, or soft rock, was found to extend in a more or less pockety belt over a district some 6 miles wide by 30 miles long, in a southeast and northwesterly direction. Matters were kept as quiet as possible and lands were bought up rapidly. Real estate soon achieved a veritable boom and speculators rushed in from all quarters. Mr. Vogt and his brother are said to have realized \$100,000 each in cash, besides controlling a great deal of land, and owning an interest in the Dunnellon Phosphate Co., which was organized in September last with a capital of \$1,250,000. The Bradleys, the well known Fertilizer Manufacturers of Boston, are said to hold 4,000 shares in the company, and Mr. Peter B. Bradley has been appointed general manager. The company owns 39,000 acres of land.

A writer in the *Engineering and Mining Journal* gives the following account, which is confirmed by Mr. Frost, of Charleston: "In the last fall some progressive orange grower in the vicinity of Ocala, with a little more curiosity than his neighbors, sent to a chemist a sample of white subsoil that occurred in his grove, and with which everybody in that section had been familiar, supposing it to be only limestone, for it had been found in every well in the neighborhood. The chemist reported that it was 80 per cent. phosphate of lime. The secret got out and then the excitement began. In the area covering Citrus, Marion and Hernando Counties it seems that almost anywhere a pit or augur will reveal phosphate."

The chief deposits are found on the banks of the Withlacooche River, about 18 miles from the Gulf of Mexico. The phosphate occurs in pockets, which sometimes extend over several areas in width. It lies in beds varying from two to sixteen feet in depth as definitely proved, and much greater depths are asserted. It is of a soft nature and can be dug by hand or by excavators, and varies in color from a dazzling white (when dried) to a cream color. Analyses of different samples range from 40 to 86 per cent. of phosphate of lime. The bed varies in quality at depths, but the average would probably be 60 to 70 per cent.

A company has also been formed at Peace River to work similar deposits, and other corporations will doubtless come into existence. But as far as we can learn there is no immediate prospect of any considerable output of phosphate. Offers to buy cargoes are refused with the response that they cannot be supplied at present, and the whole interest seems to be concentrated upon efforts to sell lands, as is not uncommon in the case of mineral discoveries, there being always a benevolent disposition to allow others

to reap the benefit of the results of actual mining. An English prospectus issued last year naively remarked that the great profit in mining ventures was usually obtained, not by the original owner nor the final purchaser, but by the middle man, and the company proposed to occupy that position. The same feeling seems to animate the investors in Florida, and it does not seem probable than any output will be produced this year sufficient to disturb the markets, which have been very firm in view of an apparent scarcity of phosphatic supplies. The news of these discoveries has caused buyers to hold off, and there has been a decline of a penny in the English market, but if shipments are not made the price will be apt to recover.

Another drawback to the success of these deposits is the uncertainty of quality. It appears to constantly vary in richness, and chemists report that it is impossible to judge of its quality by the eye. It is therefore likely to prove of a lower average by the cargo than single tests may give.

But even if the deposits are all that the land boomers claim, the growing use of fertilizers will soon absorb the surplus, and we can be sure that there will continue a demand for phosphate, and especially for the richest of them all—Canadian apatite.

The Geological Maps of Nova Scotia.

In our November issue we took occasion to comment on the rumour that the Geological Survey would issue its geological map of Nova Scotia upon a reduced scale of four miles to the inch, and we were emphatic in pointing out that such a step would be a great mistake, and was extremely undesirable to those engaged in the extensive mineral developments of that most important mining country. Our remarks appear to have borne fruit, for the subject was recently brought before the Minister of Interior in the following petition presented by the Nova Scotia members of Parliament:—

The Memorial of the undersigned members of the House of Commons, from the Province of Nova Scotia, respectfully sheweth:

That the Geological Survey maps of the Island of Cape Breton, and of parts of the counties of Antigonish, Guysboro and Pictou in the Province of Nova Scotia, have been published on a scale of one mile to the inch.

That, the further surveys made on the mainland of Nova Scotia, have been prepared and plotted on the same scale.

That we regret to learn it is proposed to "reduce" the plans to one fourth the former size, and publish the maps on a scale of only four miles to one inch.

That in the opinion of experienced men most deeply interested in the development of the mineral fields of Nova Scotia, the maps if published on the smaller scale will be so crowded as to render them almost valueless to the public for practical purposes.

That a due regard for the public convenience requires the Geological Survey for the whole province to be published on a uniform scale.

That, as the maps yet to be issued cover the most interesting districts on the mainland of Nova Scotia, embracing the coal, iron and gold mines, it is desirable in the public interest that they be published on a large scale, with clear outlines and affording the fullest information practicable. Any other course adopted will be deeply disappointing—particularly to mining men in Nova Scotia.

That the cost of publication, if that is a material obstacle, may be reduced by a cheaper process of printing, which will serve the purpose, and the cost of "reducing" the office plans can (in part) be saved—but it is submitted that in this matter practical utility and public convenience should be the chief considerations.

We therefore most strenuously protest against the proposed change in the publication of the Geological Survey maps for the Province of Nova Scotia, and respectfully urge that a sufficient appropriation be provided to continue the issue of the Nova Scotia maps on the present scale of one mile to the inch.

It appears that out of \$102,479, voted annually by Parliament for the Geological Survey, about \$5,000 have been spent every year since 1882 on surveys and explorations in eastern Nova Scotia, but that no maps and only one report, which cost \$1,335, have been published. There would perhaps be required \$6,000 to print maps of the country surveyed in these eight years, on the scale and in the manner adopted for those of Cape Breton, and the annual expenditure of \$1,025 would then be sufficient to continue the publication of maps and reports. The industrial importance of the district, which contains valuable mines of gold, coal, iron and copper, has made such close investigations expedient inasmuch that maps drawn on a scale of one mile to an inch show greater minuteness of detail than most of those published recently by the Geological Survey on four or eight miles; their value, consequently, would be greatly impaired by the errors, omissions, and crowding of lines and names unavoidable in reducing them to such scales.

Asbestos; a Review of this Important Industry in Canada.

There is probably no mining interest in Canada that has shown such marked progress, or that gives such promise of profitable and constant returns as that of the peculiar mineral asbestos. Although of comparatively recent date the many uses to which its manufacture has been applied, have increased so rapidly that it is with difficulty that the production can keep pace with the present demand, although the output from the Canadian mines has increased one hundredfold in the last ten years. The word is derived from the Greek, *Asbestos*, signifying incombustible or unquenchable, and this property was known to the Ancients many hundred years ago. The term asbestos is, at the present day, applied to minerals which differ very considerably in their mode of occurrence and composition. That which was first known as the asbestos of the Ancients is a variety of the hornblende family, and allied to tremolite, actinolite, etc. It consists of fine, somewhat elastic fibres, varying in color from almost pure white to greyish and greenish tints, and in length at times nearly or quite two feet, with a soft silky aspect, looking very much, in fine specimens, like floss silk itself. In the flame of the blow-pipe, the mineral is but little acted upon, although after being exposed for some time to long continued heat the fibre loses tenacity, and becomes brittle or even sandy to the touch. It can be spun like cotton and woven

into cloth, and can be manufactured into a great variety of substances such as fire proof curtains, wallpaper, suits of clothing, millboard, rope and steam packing of various kinds. It is of special value for the last purpose, owing to its entire non-conductivity of heat and indestructibility when in the case of the severe work it has to stand in connection with marine and other engines, it is exposed to long and constant wear; in this respect far exceeding any material heretofore employed for this purpose. It has however been found of almost too slight consistency to possess great value for textile purposes by itself, but this has been overcome by combining the spun fibres of the mineral with threads of cotton or flax, and in the museum of the CANADIAN MINING REVIEW can now be seen a complete suit of clothing from helmet to shoes such as is supplied to the firemen of Paris and other cities on the continent, dressed in which a man can walk with almost absolute impunity into the hottest flame. The face in this case is protected by a very fine wire gauze, which enables the wearer to see dimly and to respire as well as the dense atmosphere which he has to penetrate will permit. For this very unique outfit of asbestos manufacture we are greatly indebted to the kindness of Mr. Ed. Wertheim, of the American Asbestos Co. (Limited), now successfully operating mines of the mineral in Black Lake district. The suit was made at Mr. Wertheim's extensive factories at Frankfort, Germany, and is well worthy of the attention of our civic authorities, who may be interested in the better protection of our firemen. Besides the true asbestos of commerce, other varieties known as mountain cork, mountain leather, and mountain wood are met with, but these have not yet been found adapted for use in the arts or manufactures, or at least not to any very great extent.

The mineral which is produced in Canada at the present day under the head of asbestos, is in reality not asbestos proper, but a form of serpentine called chrysotile. This occurs in veins in certain portions of the great belt of serpentine rocks of the Eastern Townships of Quebec, though in the serpentines of the Laurentian also this mineral is sometimes found in small veins, but not as yet in quantity to be economically available, though possibly subsequent exploration in this direction may disclose workable deposits there as well. In the Laurentian rocks of certain area, however, the variety actinolite sometimes forms hilly masses of considerable size, which has been mined for some years, and while not as yet found to be suited for the manufacture of millboard, and the finer qualities of steam packing, answers admirably for cements, paints, etc., in the same way as the tremolite of the State of New York; these deposits of actinolite are therefore highly important, and will without doubt increase rapidly in value.

Although of such recent date, the Eastern Townships asbestos, for the name may as well

be retained, has now a world-wide reputation, and is shipped in large quantities to the various countries in Europe, England, Italy, Germany and Belgium, and to the United States also, and of the many firms now engaged in its manufacture, the greater portion draw the bulk of their raw material from a small area in Eastern Quebec; the Italian mines, from which the asbestos was formerly obtained being worked with far greater difficulty than those in Canada, while the supply of the mineral is much more uncertain, and although for certain special lines the Italian may be more valuable than the Canadian, the latter has been found of sufficient value for most purposes so as to almost entirely supplant the former, even with those firms who control the output of the Italian mineral, a fact evidenced by the late purchase of a Canadian property by the United Asbestos Co., of London, England.

Although asbestos was known at many points in Eastern Quebec more than thirty years ago, and was exhibited at the International Exhibition in London in 1862, no attempt was made to work the mineral for some years. The credit of the discovery of the Thetford area is probably due to a French-Canadian named Fecteau, and following upon his discovery certain areas were secured from the Government by private parties. The true value of the mineral was not at first recognized, and in the first year of mining operations, (1878) only 50 tons were taken out, for which a ready sale was not at first obtained. The importance of the discovery was however speedily ascertained, and new companies obtained tracts of rocky land in the townships of Thetford and Coleraine, and began the work of exploration and mining. Had the Government of Quebec at that day been in possession of the requisite information regarding its mineral lands, it is very probable that the thousands of acres which rapidly changed hands in that section of the province, would have brought in much greater returns than the usual Government rate. Curiously enough, however, though the areas of the serpentine in the townships of Thetford, Coleraine, Ireland and Wolfestown are very extensive, the portions in which the mineral asbestos is found are comparatively rare and the mining though now prosecuted for nearly a dozen years, is practically confined to two small sections about four miles apart. The first, and as yet the most important of these, is the small mound near the Thetford station on the Q. C. railway, which rises about 80 to 90 feet above the track; the other, the bold ridge of brownish looking rock to the southeast of Black Lake station, which assumes much greater prominence, and probably has an elevation of 650 to 700 feet above the railway at this point. It must, however, be said in regard to some of the areas of serpentine that lack of sufficient exposures, owing to soil and forest growth, prevents in many cases, a careful search, but in other portions where the

bare rock is well exposed as on the great ridge of Ireland and Wolfestown, as well as much of that towards Lakes Caribou and Little St. Francis, much of the rock has a hard reddish-brown weathered surface which does not promise favorable results to the prospector, who from a comparatively brief experience can very generally decide, with a fair amount of assurance, whether certain areas are likely to prove of value or not as a source of supply for asbestos.

The growth of the industry can be seen at a glance by comparing the output of 50 tons in 1878 with that of nearly 6,000 tons in 1889, a total which would have been further increased, presumably by some 500 tons at least, had the pits of the Scottish Canadian Company at Black Lake been in operation. The importance of this industry to the Province of Quebec may be inferred from the fact that this amount represents a cash value at the mines of about \$450,000, and the industry has now risen to such proportions that hundreds of thousands of dollars of capital are now seeking investment wherever an opportunity of successful operation is presented. Caution, however, on the part of those desiring to invest is advisable at present. The productive areas of the present asbestos district are very well known to those interested in the industry, and the really valuable areas now in the market can easily be counted on the fingers of one hand.

The methods of working are being radically changed. The old system of hand labor and horse derricks which have prevailed for years, and which in the face of a limited demand answered well enough so long as the depth and extent of the quarries were small, have now become entirely impracticable in the face of large pits and the urgent necessity for large production. Steam derricks, drills, and the most improved labor-saving appliances are now being rapidly introduced. All the new companies are putting in plant of the most approved pattern, with the result of much greater economy in labor and greater capacity of output, which in this case also means largely increased profit. Further improvements are, however, urgently called for, and that very speedily, if the mining of asbestos is to be carried on at the maximum of profit. Some simple appliances by which the mineral, especially the shorter and poorer grades, can be separated without the tedious process of cobbing by hand, should be the earnest study of all interested in the business of mining, and what is at present of quite as much importance, especially in the case of those companies who have been at work for some years, is the necessity of getting rid of the huge and unsightly dumps which now cumber the good ground and limit very seriously the extension of operations as well as the profitable working of some of the pits now carried on.

There is no doubt that in the case of the Thetford mines these dumps cover some very rich ground, and the same remarks apply also

to certain areas at Black Lake. The mining of asbestos at either place has not been of a highly scientific character, and during the visit of the American Institute of Mining Engineers to this section last October, many remarks of this character and as to the desirability of placing these mines on some more desirable basis for future successful operations were expressed. In particular the bad management of the dumping ground was commented on. The removal of these, however, should not, if properly undertaken, be attended with any serious loss, and might even possibly be conducted with profit. It is well known that in the early years of the industry the separation of the smaller veins was not closely attended to. Large veins were plenty, and cheap and speedy extraction was a necessity, consequently much very fine fibre went into the lower part of these unsightly heaps of what is regarded as refuse. In fact even in the newest portions of these dumps, veins of asbestos ranging from half to three-quarters of an inch can be frequently seen, all of which should repay extraction if suitable machinery were employed. While in the present condition of most of the pits, veins of asbestos of large size, ranging from one to three or more inches, are common, the uncertain nature of the mineral is such that in view of the investment of hundreds of thousands of dollars at which many of these properties are now held, when any are placed in the market, the great desirability of testing the rocks at lower levels by some cheap but satisfactory method should be apparent to all interested, and not only so but on the part of an investor is almost a necessity. To the company investing many thousands of dollars in an asbestos property to-day, the chances for successful working, or of getting back their own with profit, depend very largely upon the continuation downward for a considerable depth of profitable veins; for while in the case of a property, acquired at Government rates of \$1 per acre, the capital upon which dividends must be paid is very small, the case is very greatly reversed when a price of \$1,000 to \$3,000 per acre is demanded, and the cost of a plant sufficient to put such a property on a satisfactory working basis is added. This means a very different method of conducting mining operations, and a constant and sure source of supply for some years to come at least is a first requisite. The advisability of thus testing the lower portion of the serpentine has been pointed out in the reports of the Geological Survey, and the use of the diamond drill by which cores could be readily obtained at a very cheap rate from a number of holes, bored at different angles, advocated. The cost of boring such holes to a depth say of 150 to 200 feet should, when the machine is on the ground, not exceed fifty cents per foot, and should veins of asbestos reticulate through the rocks as plentifully at such depths as are now seen

at the surface, their presence would, without doubt, be recognized in some of the holes.

As regards the present status of the industry, there are at present engaged in mining at Thetford no less than six companies, two new ones having commenced operations during the past season, viz., Messrs. Lucke and Mitchell, of Sherbrooke, and A. H. Murphy & Co., of Montreal. The low lying area between the railway and the Thetford River has been proved to some extent by different parties, and while promising veins have been found at several points, these do not appear so numerous or so important as regards size and quality as those in the knoll at Thetford station. These areas should be thoroughly tested and their value ascertained before dumping grounds are located there, which may require to be removed again before long, since it is very possible that large and important veins may be concealed. On the property of Lucke & Mitchell several veins of very fine fibre, in thickness up to nearly two inches, are found in a portion of the low lying area, so that care is necessary in laying out the work for the future.

At Black Lake several new companies have taken up areas and commenced development work, preparatory to mining during the coming season. These are for the most part located contiguous to the line of the Quebec Central railway to the southwest of the present workings, and adjoining the mine of the Anglo-Canadian Co. Among these new companies are the St. Julie Mining Co., the Black Lake Mining Co., and the Laurier Mining Co., but in none of these has the development reached such a point as to enable one to pronounce definitely upon the success of the several undertakings. The works of the American Asbestos Co., on the high ridge southeast of the Black Lake station are, however, worthy of mention for the amount of work done during the past season, and for the energy and system displayed, as well as for the good results already obtained. This mine is at the highest elevation of any at present worked. The plant is excellent, and the quality of much of the fibre very good, a fair proportion ranking No. 1. New workings of the Anglo-Canadian in the face of the high hill which is about 350 to 400 feet above the railway at this point also show excellent veins of asbestos, while in the pits of the United Asbestos Co., which has lately acquired the property known as the Frechette-Dauville mine and which is intermediate in position between the Scottish and the Anglo-Canadian mines, some very fine "cotton" is obtained, the percentage of firsts from this pit during the past season probably amounting to over forty per cent. This mine is now being thoroughly equipped with steam derricks, compressors, drills, etc., by the Jenckes Machine Co. of Sherbrooke, who have lately made a specialty of mining machinery.

To the north-west of the Coleraine station, adjoining the area of Fenwick and Sclater, opera-

tions have been commenced during the past season by W. H. Lambly & Co., of Inverness. Near the crest of the hill in which this mine is situated several very good veins are seen, but work has not sufficiently developed the property to ascertain the value of the lower cuttings. As in the case of the copper industry some years ago, an asbestos boom will doubtless set in, and some of the many properties placed upon the market will furnish very poor returns to the investors. All is not gold that glitters, and all serpentine is not asbestos bearing. The folly of placing at greatly inflated prices, properties comparatively undeveloped, should be avoided in the interests of legitimate mining. While from certain standpoints the prospective profits of asbestos mining may seem very large, the actual returns are not in all cases commensurate with the expectations. The figures quoted of prospective output and profit in several of the prospectuses which have lately appeared, can never be realized, since these figures are, to a large extent, based upon an exaggerated output of first quality, chimerical ideas which in the case of the properties mentioned can never be realized either for quality of fibre or quantity of production; and it should be the endeavour of every one engaged in legitimate mining to discourage any attempts that may be made to flood the market with undeveloped and sometimes unprofitable areas, at figures which even the most profitable mines at the present time would scarcely warrant. The profits from asbestos mining must very largely be obtained from the output of "firsts" and "seconds." There cannot at present prices be any great margin in "thirds," and still less on "waste," and as the percentage of "thirds" from some of the mines is nearly equivalent to half the output, the source from which profitable returns can be reasonably looked for is largely reduced. These proportions can readily be seen from the figures quoted in the last issue of the Geological Survey, where the percentages of the different grades for the several localities are stated, as also in an excellent paper by Dr. Ellis on the mining industries of Eastern Quebec, read before the Ottawa Meeting of the American Institute of Mining Engineers, and reproduced in another portion of this issue.

Notable Prosperity of Port Arthur Mines.—In his address to the Board of Trades Mr. Thomas Marks, the president, dealt at considerable length upon the rapid growth and development of the mines in the vicinity of Port Arthur, indicating the prosperity of the mines in the following terms:—The Port Arthur silver district continues to be prominent, and never in the history of silver mining here have matters looked so prosperous. Large shipments of ore have been made all through the season, new mines are being worked and prospects developed, and altogether, affairs in the Port Arthur silver district are bright and business like. The recent dividend at the Badger of ten per cent on the total capital stock of \$250,000, after having returned to the proprietors all the money invested by them in mining, machinery, purchase of lands, &c., some \$200,000; the rise in Shuniah Weachu stock, the development at the Beaver, the rich ore body struck at the Elgin, the showing at the West End, one and all point to the eventual value to the district and our people of the silver mines.

Quebec Crown Lands; Gross Misrepresentation of the Output of Quebec Mines.

In his Annual Report, recently issued, the Commissioner of Crown Lands for the Province of Quebec announces that the revenue from the sale of Crown lands during the past year has been \$58,818.94, of which \$4,997.50 was realized from mining lands. The foregoing figures, he says, "show that the Province is making progress, and that our sources of revenue are being developed in a satisfactory manner." Quite so; but unfortunately it is progress towards the time when the revenue will decline from the exhaustion of the forest, and the depletion of rich areas of mineral wealth which, under a just and equitable system of mining laws, ought to be yielding a large and increasing yearly income to the Provincial Treasury. Again, we are informed that "the fees on permits, etc., granted to persons interested in mining amounted to \$124, and the expenses to \$3,229.27." We have been told that the Government has under consideration a revision of its effete system of mining laws; surely it is full time when such an absurdity as this appears from year to year in its Blue Book. Appended to the report is a statement of the work done by the Mining Service for the year, in which some statistics of the production of the Quebec mines form a prominent and attractive feature—we say attractive, for any one conversant with these industries cannot fail to be impressed with striking instances of their glaring inaccuracy. Here, for instance, are a few of the discrepancies:—

PHOSPHATE.

QUEBEC MINES, 1889.	Mr. Obalski's Fanciful Figures.	The Actual Shipments.	The REVIEW's Authority for its Returns.
Name of Company or Mine.			
	Tons.	Tons.	
Ottawa Phosphate Co.	3,500	1,300	Lomer, Rohr & Co.
Canadian Phosphate Co.	7,300	6,040	Millar & Co.
Central Lake Mining Co.	1,000	210	Lomer, Rohr & Co.
Phosphate of Lime Co.	6,500	6,886	Wilson & Green.
Dominion Phosphate Co.	6,000	8,350	Lomer, Rohr & Co.
Little Rapids	500	<i>Nil</i> ; no shipping done.	W. A. Allan.
Blackburn Mine.	1,500	800	Lomer, Rohr & Co.
Jackson Rae.	200	<i>Nil</i> .	do
Chapleau Lot.	Not mentioned.	125	do
Grier Lots (East Templeton)	do	100	do
Chas. Lionais & Co.	150	170	do
Bassin du Lièvre Mining and Milling Co.	1,700	Did not raise a pound.*	.....

* "These 1,700 tons," write Messrs. Lomer, Rohr & Co., "are certainly incorrect, as this company did not raise any phosphate during 1889. They ground for the Canadian Phosphate Co., the Ottawa Phosphate Co., as well as for ourselves, all of which has been included under the shipments of the different companies."

ASBESTOS.

Thetford District.	3,850	4,803	Quebec Central Ry. Returns.
Black Lake	1,560	1,725	do do
Coleraine	175	124	do do
Broughton	6	8	do do
Lévis	Not mentioned.	16	do do
Danville	328	400	Estimated; Irwin & Hopper.

INDIVIDUAL INACCURACIES.

American Asbestos Co.	380	530	American Asbestos Co.
United Asbestos Co. (formerly Frechette)	330	379¾	Mr. Frechette.

COPPER.

QUEBEC MINES, 1889.	Mr. Obalski's Fanciful Figures.	The Actual Production.	The REVIEW's Authority for its Returns.
Name of Company or Mine.			
Eustis Mining Co. (Including 1,700 matte.)	Tons, 33,000	Tons. 34,089 (Inc. 1,773 matte.)	Eustis Mining Co.
G. H. Nichols & Co.	35,000	36,000	G. H. Nichols & Co.
Cillis and Moulton	2,000	No shipm'ts; 2,000 tons raised, est'd	Dr. Ells.
Memphremagog Mining Co.	900	800	Mining Bureau, Geol. Sur. Can
Excelsior Copper Co.	255	255	Quebec Central Ry. Returns.

FELSPAR.

Villeneuve Mica and Mining Co.	250	411	Canadian Pacific Ry.
-------------------------------------	-----	-----	----------------------

IRON.

Bristol Iron Co.	Not mentioned.	2,650 Shipd. Nov. & Dec.	Bristol Iron Co.
-----------------------	----------------	-----------------------------	------------------

Differences in other returns are also apparent; but we think these figures are sufficient to show that absolutely no reliance can be placed on Mr. Obalski's statistics. Mr. Obalski states that these estimates are very approximately made; this is just what we object to. The accurate returns of the shipments of phosphates, asbestos, copper and the other minerals are accessible at the end of the year, and can readily be obtained if the information is sought from the proper quarters. There can, therefore, be no excuse for discrepancies like these in statistics bearing the impress of Government authority; they are misleading to the public, and do great injustice to the mines and the very promising industry which they represent.

A Lesson from the Toronto Fire.

If the destruction of the University of Toronto, deplorable as we all must feel it to be, will only impress upon Parliament the very urgent necessity there is of better protection from a similar and what would be a more serious disaster to our Geological and Natural History Survey Museum and offices, it will not have been an unmixed evil. As we have repeatedly pointed out in these columns, the present incommensurate structure is utterly inadequate to the wants and uses of the institution, and adjacent as it is, to a number of rickety old fashioned buildings, it has absolutely no protection against destruction by fire. At present it holds the most precious collection of minerals, fossils, and botanical specimens contained in any one building on the American continent. The loss of such a valuable collection would be irreparable. In a monetary sense they represent more than a million of dollars. Surely these are worthy of a better fate? If, instead of indulging in jealous intrigues and internal bickerings over family troubles, the members of the staff would unite in pressing the urgency of this matter with half as much energy and zeal as they have lately displayed in pulling the political wires for purely personal ends, something definite might be done to avert a public calamity, which may occur at any time under existing circumstances. Now that Parliament is in session it is both right and proper that the facts should be placed before the representatives of the people, and that they should be asked to assist the Government by their support, in projecting the erection of such a structure as would place Canada abreast of the other nations of the civilized world in the march of improvement.

Imports of Coal, by Water, at the Ports of Montreal, Sorel, Three Rivers and Quebec, for the Years 1888 and 1889.

(Authentic figures compiled for the REVIEW.)

	MONTREAL.		SOREL.		THREE RIVERS.		QUEBEC.		TOTALS.		REMARKS.
	1888.	1889.	1888.	1889.	1888.	1889.	1888.	1889.	1888.	1889.	
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
CAPE BRETON MINES—											
“International”	72,341	82,879	1,191	.....	.....	.....	4,615	3,841	78,147	86,720	Inc. over 1888, 8,573
General Mining Association.	45,917	45,297	6,698	8,404	3,500	1,300	25,073	21,828	81,188	76,829	Decrease, 1888, 4,359
Sydney & Louisburg Coal & Railway Co.	48,777	48,915	.....	3,900	.....	.....	7,689	5,759	56,466	60,074	Increase, 1888, 3,608
“Caledonia”	46,414	33,454	9,739	9,910	.....	3,000	.....	10,077	56,153	56,441	do 1888, 288
“Gowrie”	38,837	32,106	10,898	7,372	.....	.....	583	550	50,318	40,028	Decrease, 1888, 10,290
“Glance Bay”	39,933	31,411	1,500	4,819	2,184	2,089	1,368	.....	44,985	38,319	do 1888, 6,666
PICTOU COUNTY MINES—											
“Intercolonial”	54,906	35,452	.....	9,200	.....	.....	.....	.....	54,906	44,652	do 1888, 10,254
“Vale” and “Acadia”	22,073	1,213	.....	.....	.....	.....	.....	.....	22,073	1,213	do 1888, 20,860
FOREIGN COALS—											
Scotch	21,733	12,331	.....	.....	.....	.....	25,474	21,273	47,207	33,604	do 1888, 13,603
English	5,580	4,791	.....	.....	.....	.....	12,256	15,948	17,836	20,739	Increase, 1888, 2,903
Welsh Anthracite	4,155	8,286	.....	.....	.....	.....	4,105	.....	8,260	8,286	do 1888, 26
	400,666	336,135	30,026	43,605	5,684	6,389	81,163	79,276	517,539	466,905	

Rumored Discovery of Coal North of Lake Superior.

Late Port Arthur papers are full of accounts of supposed discoveries of coal said to have been made in the country north of Lake Superior. From time to time similar discoveries have been alleged to have been made in various parts of the Provinces of Ontario and Quebec in localities where it would be almost impossible for coal to occur, if there is any truth in the conclusions of geologists. On looking into the question and reading what is said in the reports of the Geological Survey as to the rocks of the region referred to, we have come to the conclusion that while nothing is impossible, it is *exceedingly improbable* that coal of any kind exists in the region to the north and northwest of Lake Superior. Dr. Bell in his report for 1877, describes beds of lignite in the drift along the Missinaibi River far to the northeast; but in his report for 1886 the same gentleman gives reasons why true coal need not be looked for in the great region westward of James Bay, including the country in question. No coal has been found in any part of the world in rocks of such ancient date as those which occupy the whole country to the north and west of Lake Superior or until we come to the plains; and Dr. Bell shows that the evidence of the drift is all against the chances of finding coal anywhere to the northeast. The Geological work bearing on this problem having been done already by the Dominion Survey, we do not see that anything is to be gained by the proposal to ask for \$1,000 from the Government of Ontario and the same amount from that of the Dominion. The ignorance of the results already arrived at by our own Survey appears to be at the bottom of much misunderstanding which might be obviated if the Reports of the Survey, or rather a summary of them, were better disseminated. Cases of this kind show the necessity of finding better means of diffusing among the public the valuable information already acquired at the public expense.

The Economic Geology of Ontario.

Although the Report of the Royal Commission appointed to enquire into the mineral resources of Ontario is not yet ready for distribution, we have been favoured with a glance at the advance sheets of that portion of it which has special reference to the economic geology of the Province. Dr. Bell has evidently done his work in a painstaking and highly creditable manner, and has succeeded in condensing into some fifty pages, not only an interesting, but a scientifically accurate description of what is known of the geology of this section of the country up to the present time. The first part of his report defines the proper meanings of some of the commoner geological terms which are often too loosely used, and explains the origin of the

proper names in Canadian geology. An outline is then given of the various rock systems and formations of Ontario, and each is described in the light of the most recent investigations. These divisions are described in their chronological order. The origin of the various Laurentian rocks and the true position and relations of the Huronian system are clearly stated. After the general description of the Huronian the leading facts are given as to iron, copper, nickel, silver, gold zinc, antimony and other ores in this pre-eminently metalliferous formation. The Animikie, or silver-bearing formation of Lake Superior is described in an interesting and intelligible manner, and all dates of discovery, workings, etc., are accurately stated, Dr. Bell having been personally familiar with these. The various unaltered formations with their accompanying economic substances, such as salt, gypsum, petroleum, natural gas, etc., are described in their proper order. Dr. Bell is a specialist in surface geology, and devotes a few pages to a graphic summary of this branch of geology as far as it refers to the Province of Ontario. A few pages are added in regard to the copper, nickel and gold mines of the Sudbury district, so as to bring the subject up to the end of 1889. Taking it in its widest sense we do not remember to have read any geological report which, for the number of pages, has proved so interesting and satisfactory. We understand that the complete Report of the Commission, which, as we have said before, has been far too long delayed, is to be submitted to the Local Legislature during the present session.

Importation of Mining Machinery.

In the House of Commons on the 31st inst.

Mr. Lister asked whether the Government has allowed any machinery used in the copper or nickel mines at Sudbury to be imported free of duty, or to be used in bond? Has the importation into Canada of any mining machinery been permitted without the payment of duty during the past five years?

Mr. Bowell—Application was made for the admission, free of duty, of some machinery that had been used in the mines of the United States, for use in the copper and nickel mines at Sudbury, Ontario, which was conceded by Order-in-Council. The British Columbia Government appropriated a sum of money to purchase machinery for the purpose of erecting reducing works in the Cariboo district, British Columbia, upon which duty was paid, and application was made to the Dominion Government for a refund of said duty as such machinery was not manufactured in Canada. That application was granted. No refund has been made, for the reason that it has not yet been shown to the Department what portion of the machinery imported is not manufactured in Canada. When that is done, a refund will be made.

The Natal Coal Fields.—The existence of extensive coalbeds in Natal of a rather better quality than any yet found the Cape Colony has long been known; but owing to the absence of any local demand and the prohibitory cost of transit by ox wagon, they were almost unworked until recently, when the railway from the port of Durban was extended sufficiently near them to admit of a portion of the supply for the locomotives being conveyed to the line. An extension of the railway to the Transvaal border, now in progress, will admit of the coal being put direct into the trucks, when it is anticipated that the Natal railways will be worked exclusively with local coal, and that the coasting steamers will also be supplied with it. Mr. William Milne, locomotive superintendent of the Natal Government railways, considers that some descriptions of Natal coal are almost equal in steam-generating properties to South Yorkshire coal, which was exclusively used formerly on the Natal railways.

LETTERS TO THE EDITOR.

Phosphate Analyses.

LONDON, ENG., January 15th, 1890.

The Editor,

SIR,—I have read with great interest Captain Adams' letter in your November number on the subject of the sales of Canadian phosphate in Europe.

The first point about which Captain Adams complains is the cash discount of 2½%, the answer to which is that it is the custom of the trade. I should imagine that when Captain Adams purchases machinery or supplies for his mines that he secures a discount for cash payment; but in addition to this there is another matter to be considered, viz.: that the broker in Europe who sells the phosphate to the manufacturer often has to take the risk of drawing on his buyer, whereas he accounts to his seller on a cash basis.

The next point is the moisture question. A few years ago when phosphate was sold "as it rises" (*i. e.* analysis on the normal state) it frequently happened that the test was below guarantee, simply because the moisture was taken into account in the analysis and was not deducted from weight, the result being that a cargo of phosphate sold as 80% and which tested say 81% on the dry basis, but only 79% in its natural state was rejected for being below guarantee and a heavy allowance claimed. Captain Adams also appears to lose sight of the fact that what is lost in weight is made up in the analysis which is proportionally higher; and further than this, the phosphate being sold with one-fifth of a penny rise for every unit above guarantee, the seller secures an additional price for every unit, as the rise is taken on the analysis of sample dried at 112°, and not on the analysis in normal state. On a cargo testing say about 83% on dry analysis, and only 80% in normal state, the gain to the seller would be about 4s. 2d, or \$1 per ton.

Further, Captain Adams, while on the one hand objecting to have the moisture deducted from weight, claims on the other to have his phosphate analysed on the dry state; in other words he wants to be paid the phosphate price for any moisture which the cargo happens to contain.

To come now to the question of difference in tests of samples taken on shipment and on discharge, Captain Adams appears to have been singularly unfortunate in his experience. For the last two years all the phosphate shipped by the Canadian Phosphate Co., limited, has been analysed previous to shipment, and the results obtained on both sides have been practically identical. I think an explanation of Captain Adams' trouble may possibly lie in the fact that his shipments may have been mixed ones, *i. e.* the collective output from a large number of pits which gave different grades of ore, and would be therefore very difficult to sample. I have seen the sampling done at numerous places in England and on the continent, and I am of opinion that the current system of taking about 1% of the cargo as it is being discharged from the ship is as fair a method as could be adopted, for the whole sample taken is ground up to powder and well mixed before the final samples are taken. In the case of mixed shipments it is more probable that the discharge sample would be the correct one, as after the double or treble handling, the various grades would be thoroughly distributed through the whole cargo. I think, however, that in taking samples up country at the mines, a loss of 1% in the test should be calculated on, seeing that the phosphate is likely to get a certain amount of extraneous matter mixed with it during its conveyance from the mines to Montreal, and during shipment from the dirty wharves provided at Montreal.

I do not at all agree with the suggestion to leave the sampling to one recognised authority, for in cases of disappointment on the part either of buyer or seller, which would be sure to occur sooner or later, the trouble would recommence. In addition to this the cost of sampling, which is now very trifling, would be most materially increased, for such a sampler would want at least four or five guineas a day, and as he would have to be waiting at all times in the docks until the steamer commenced to discharge the phosphate, payment would have to be made for about four days work on each shipment.

As to there being anything in Capt. Adams' argument that buyers' chemists are *ipso facto* lower than sellers', this I do not for one moment admit, for in one contract A will be the chemist for Buyer and B for Seller, in the next *vice versa*, and so on. For my own satisfaction I have made a list of a number of cargoes, and I find in adding up the total of thirty tests by buyers' chemists and by sellers', that whereas the sellers' tests gave a total of 2423 units, buyers gave 2433, or an average difference of

about $\frac{1}{2}\%$. I have seen cases where differences between chemists have been 2% or even 3%, but the reference to the 3rd chemist always settles this point.

On the question of reductions claimed for cargoes being under test, Capt. Adams has given your readers but one side of the case, viz.: the seller's, who, having delivered a cargo inferior to what he has sold and guaranteed, finds himself obliged to suffer in consequence. Now let us consider the buyer's position. A manufacturer has a buyer of say 1000 tons of 18% superphosphate; before accepting the order he enquires the price of the cheapest phosphate from which he can make this quality: he chooses perhaps 80% Canadian and buys 500 tons with which to fill his order. When the Canadian phosphate arrives it tests say only 78%, or not sufficiently high to enable the manufacturer to make the superphosphate he has sold. The manufacturer has therefore to replace with material from another source, and it frequently happens that he has to pay a higher price for his raw material. He therefore not only loses part or all of the profit he calculated on making, but finds his work blocked with a lot of material which he did not want. Therefore, in making an offer for the same he calculates the loss he has incurred in having to buy other material, and deducts this from what he considers the value to him of the 78%, which he never bought, and which the shipper who sold him 80% expects him to keep. I have certainly known cases where claims have seemed excessive, but it is not always possible to know how the buyer is placed by the default in guarantee, and the broker or agent in Europe being thus between the buyer and seller, may find himself in a truly trying position, his seller having delivered a cargo below guarantee and his buyer claiming a heavy allowance. The seller thinks the broker is not looking after his interest in settling with a heavy allowance, and the buyer refuses to listen to any new offers of phosphate made by the broker, because he cannot rely upon receiving what he has bought. I have known instances where the buyer has consented to a re-sampling in order to satisfy the Canadian seller, but I have never yet heard of a case of this kind where the second sampling has given any appreciable difference from the first.

As to selling phosphate on a sliding scale without guarantee, the proposal is absolutely impracticable, for the manufacturer only buys phosphate of that particular grade which enables him to produce the superphosphate for which he has buyers.

In conclusion, though I admit there have been troubles in the Canadian phosphate trade, I am of opinion that it has in most cases been the fault of the sellers, who generally imagine their phosphate to be of a better quality than it really is; but I think that now that the industry is beginning to be more seriously studied and treated with more system, the results obtained in Europe will not be a cause of dissatisfaction to the Canadian sellers.

I am, yours, etc.

C. C. HOYER MILLAR.

MONTREAL, Feb. 15th, 1890.

The Editor,

SIR,—With your permission I would like to have space for a few remarks on the subject of Phosphate Analyses, which has been under discussion in your columns for the last three months.

There is no doubt that in the past, miners of Canadian phosphate have been disappointed at the valuations of their ore at European ports, even though they have based their expectations of returns on analyses of their goods made by Canadian or U. S. Chemists. The question is, what has been the cause of their disappointment? Is it the sampling, or the analysis, or both? I have had some little experience in sampling, with more in analysing Canadian phosphate, and I am firmly of opinion that very many, if not all, the cases of disappointment are to be traced to improper sampling of the ore, either here or on the other side of the water.

Sampling, as Mr. J. Lainson-Wills very properly remarks in your January issue, is no easy matter, and it is high time that our miners should pay more attention to the matter here, as well as at the port where the European purchaser accepts the cargo. More careful attention to this matter will, I am convinced, result in fewer disappointments when accounts of sales are received.

As to the analysis, chemists, both on this continent and in Europe, are almost a unit in using what is known as the Molybdate method, and when working on duplicate samples find no difficulty, as a rule, in obtaining closely concordant results. At the same time it must be admitted that the correct determination of the amount of phosphoric acid in a sample of ore is by no means an easy matter; indeed, in the valuation of no other commonly occurring ore is greater care required.

In conclusion I may be permitted to add that I am surprised to see Mr. Lainson-Wills advocating the method of analyses he outlines in the January REVIEW. This method, which is uncertain, and likely to give too

high results, has for some years been almost universally discarded in favour of the Molybdate method already mentioned.

I am, yours, etc.,
J. T. DONALD.

MONTREAL, Feb. 21, 1890.

The Editor.

SIR,—I have read with interest the comments made by correspondents in your January number upon my previous remarks as to the commercial difficulties attending the sale of Canadian phosphate. Mr. J. Lainson-Wills, in his learned article, waives aside the question by saying: "the commercial dealings offering no difficulty to any competent man of business." So it appears that the whole trouble is due to the incompetency of Canadian shippers, and as they all, without exception, have suffered severely from the causes indicated, they all stand condemned. If our inefficiency is the cause of all our troubles, it is well that we should know it; but it would be a kindness to us if Mr. Lainson-Wills would give such instruction as might enable us to reform, or else convince us of our hopeless incompetency and induce our retirement *en masse* from the business in favor of competent men. His prescription of Maret's method of analysis is said by our best authorities to be defective, but he hits the mark when he suggests that "the same method of analyses be adopted by the respective chemists."

Mr. Hutchinson's analyses show a gratifying agreement, in no case being as much as one per cent. different. But his statement confirms my assertion that the buyer's analysis is lower than the seller's in a large proportion of cases. *In the five instances which he gives the buyer is lower every time.* I denounce this as a grave commercial scandal worthy of the attention of the honorable chemists whose reputation is necessarily involved in such a condition of things. Chemical reactions certainly cannot vary with the differing commercial interests, nor can the chemists be supposed to prostitute their noble science. The explanation is that different methods are used, and after a little experience it is found out that certain men are usually higher or lower in their results, and these henceforth become sellers' and buyers' chemists, respectively. The fault, if it be a fault to follow the recognized custom of taking every possible advantage in trade, lies with the merchants and manufacturers, and the remedy rests with the chemists. Let them adopt uniform methods of analysis, and we shall doubtless secure an average agreement in results.

Yours, etc.,

ROBT. C. ADAMS.

Cobalt in the Nickeliferous Pyrrhotite of Sudbury.

MONTREAL, Feb. 11th, 1890.

The Editor,

SIR,—In a recent issue of your Review reporting the Transactions of the American Institute of Mining Engineers in Ottawa, I noticed a statement to the effect that pyrrhotite never contained cobalt.

In December last, a specimen of Sudbury pyrrhotite free from gangue was placed in my hands for analysis. On careful investigation it was found to contain 3.843 per cent. of nickel and 0.59 per cent. of cobalt. I may also add that it contained 0.33 per cent. of copper.

Cobalt is found in the pyrrhotite of Elizabethtown, Ont., and in that of other localities in Canada.

Apologising for encroaching upon your valuable space, I am,

Yours, etc.,

MILTON L. HERSEY, B.A. Sc.

Chemical Laboratory, McGill College.

Metallurgical Progress in 1889.

The metallurgical progress of the past year has been mainly in the direction of perfecting existing process rather than in that of new discovery, at any rate as far as can be judged by communications made public. At the spring meeting of the Iron and Steel Institute considerable interest was exerted by a record of experiments on the addition of nickel to iron and steel, which had been carried out at Halside in Scotland, by Mr. James Riley, and showed that lined steel containing 5 per cent. of nickel has its elastic limit and alternate strength raised by nearly one-half, while the hardness is but slightly augmented. With the large increase in the supply of nickel from Canada, it is not improbable that steel of this kind may become practically useful at no distant date. The open hearth furnace, variously modified both as regards shape and material of construction, continues to increase in usefulness. For the large purposes, such as the ingots required for modern artillery, furnaces of 30 to 40 tons capacity are now frequently employed, and the increasing use of dephosphorising methods, even with the highest class of pig iron, is specially noticeable. This is rendered possible by the use of refractory basic materials, such as caustic magnesia, and more particularly chromic iron ore, the latter being used not only for melting furnaces but also for the beds of reheating furnaces.



In General.

Messrs. Andrew Hunter & Co., 4 Fenchurch Avenue, London, Eng., have acquired the business formerly carried on by Messrs. Moller, Gaetz & Co., as chemical brokers and phosphate merchants.

In another portion of this issue we publish a summary of the evidence in the suit of the Hamilton Fertilizer Co. vs. Wilson, which opened at Hamilton on the 7th inst. The suit was for payment of a note for \$120 given for a shipment of "Sure Growth Fertilizer." The analysis of the fertilizer gave:

Phosphoric acid, soluble in water.	0.86 %
Soluble in citrate of ammonia . . .	5.61
Insoluble	1.71
Ammonia	5.40
Potash	5.24
Moisture	7.03

The defendant alleged that it had not benefited his crops, and refused to pay. In all probability the fertilizer did not produce immediate effects owing to deficiency in soluble phosphoric acid, but the land will perhaps show its good effects in the following years. Since this was written, we find that pressure upon space compels us to withhold the evidence and verdict in this case.

Markets.

The following is an extract from Messrs. Couper Millar & Co.'s circular under date of 16th ult: The "Corner" in phosphates becomes daily more acute, and it is hard to say how manufacturers' wants are to be supplied during the spring months. Long prices are being paid by continental buyers for high test material, and very little obtainable, while medium and low test is scarce, the strike of the coal workers on the Continent having actually shut up some of the works *pro tem.*, which tends to aggravate the situation, they pleading "*force majeure*" as a reason for non-delivery on existing contracts. Mineral phosphates.—South Carolina offering sparingly at 11d. to 11½d. per unit according to port. Some continue scarce; indeed, there is very little available for early delivery of any test. Canadian enquired for, but raisers are not disposed to sell yet at even 1s. 3d. per unit for 80 per cent. with 1-5 of a penny rise, basis London delivery. Belgian, owing to the coal strikes, is, generally speaking, off the market for the present. Aruba is not offered, and the much-prized Curocoa does not come forward. Cambridge and Bedford coprolites wanted, but what little is raised is consumed in the district.

Later advices, under date of 10th February, state that the "boom" in Florida phosphates has had a tendency to depress the market, and quotations for Canadian are a penny less. 1/3d. can be obtained at Hamburg, and 1/2d. for English ports. South Carolina has dropped 50 cents per ton, equal to one half-penny per unit. 65% phosphates have been sold for next year's delivery at nine pence, which is an advance of one halfpenny on last year's prices.

Freights.

The outlook for the coming season is good. Quotations are as follows: Liverpool, 6/3d.; Glasgow, 6/3d.; London, 7/6d.; Hamburg, 12/6d. to 15/. An unprecedented number of outside vessels are reported to have been secured for deals, and plenty of room is therefore anticipated.

Templeton District.

Mr. A. S. Thomson, of Toronto, is now operating with a small force on Lot 27, Range 10, in the district of East Templeton. During December about 60 tons of No. 1 ore were mined and hauled to station.

Operations are now going ahead at the McLaurin property, lot 7. A couple of boilers and other machinery have been shipped, and, as soon as the snow leaves the ground, work will be pushed actively on the other portions of the property.

About 900 tons have been shipped to the front from the Blackburn since the beginning of the year. The average daily output at present is eleven tons, with a force of 50 men. Three boilers and four steam drills have been added to the plant, and the prospects for a large output during the coming season are good.

The Annual General Meeting of the Templeton and Blanche River Phosphate Co. was held at Montreal, on the 1st inst. The following directors were appointed:

Wm. Cassils, president; R. McLea, vice-president; Dickson Anderson, managing director; Hugh Graham, J. M. Kirk, Henry Hogan, A. Holden, directors. The retiring directors were H. J. Beemer and T. Trimble. Mr. P. S. Ross was re-elected secretary to the company.

A little mining has been done on Lot 35 in the Gore of Templeton with most satisfactory results. A vein of pure green apatite forty-four feet long by three feet in width, and other "shows" equally promising, have been uncovered. The owners will resume working as soon as the snow leaves the ground.

Mr. Wm. MacIntosh, of Buckingham, is hauling phosphate to the Blanche from his Murphy lot. Recent developments are reported to be highly satisfactory.

Lievres District.

The output of the North Star to date is estimated to have been a little over 2,000 tons. Mr. R. N. Hall, M.P., of Sherbrooke, is now in London with the object, we understand, of placing this productive and well developed property, associated with some adjoining Lots, in the hands of an English syndicate which proposes to acquire them. We have heard it stated on good authority that the profits of this company on last year's operations were between twenty and thirty thousand dollars. Capt. Williams has a force of some 60 men now in the pits, which are all doing well.

The High Rock Mines, which lately have been in rather hard luck, are now looking very much better, and all the pits, particularly the Cap Rock, are turning out satisfactory outputs once more. Foreman Smith is now running a tunnel from No. 11 through to No. 9, and anticipates the discovery of some rich veins.

The pits of the Canadian Phosphate Company, although slightly troubled with water lately, have been turning out exceedingly well. Especially is this noticeable in No. 2, where large masses of high grade are found and the pieces being too large for the tubs are being hauled up by chains. The Star Hill Landing is well filled up with various grades of ore, ready for shipment on the opening of navigation.

The Anglo-Continental Guano Co. has appointed Mr. Smith, a gentleman reputed to have an extensive experience in the mining of phosphates in Europe, as the superintendent of their recently acquired property. Mr. Smith has arrived at the mines, and is now engaged in operations preliminary to more active work.

At Little Rapids, work on the newly discovered fissure proceeds with a small force. Developments are reported to show three feet of clean ore in the vein. This property is now in good shape for more extensive workings.

Some very important developments have been made during the past few months on lot 27, in the 4th Range, Portland West. Average samples of the ore, which is red in colour, have analysed 89 per cent. of tribasic phosphate of lime. Mr. Lainson-Wills reports it to be the most remarkable surface showing of apatite in this country, covering, as it does, an area of about 200 feet by 40 feet, and revealing the existence of a vast deposit of the purest crystallised red apatite, having a course of N.W. and S.E.

Peter Powers and a force of some 25 men continue to make satisfactory headway at Central Lake. The mine is being outfitted with an excellent plant comprising 40 H.P. boiler, drills, steam hoist and other machinery.

Mr. S. P. Franchot, of the Emerald, is now in London.

The Dominion Phosphate Co. (of London) have some fifty men working under Manager Gibbs. This mine is also being equipped with new machinery, including 50 H.P. boiler, additional steam hoists, drills, derricks, etc. A couple of large scows for the shipment of their output below the rapids are in the stocks.

Kingston District.

We regret to have to record this month two very deplorable accidents, which resulted fatally, at the pits of the Foxton mine. The accident on the 4th inst. is described by an eye-witness as follows: Dennis Mooney, working in one of the shafts, 150 feet deep, placed a portion of a steel drill on the bucket to be taken to the surface. When he thought everything was clear he resumed his work, but he did so too soon. The bucket was being pulled from the opening just about that time, and, canting, the point, which is about 11 inches long, descended with great force. It came in contact with Mooney's head, cutting through his hat and then through

his skull, and wedging itself solidly in his head, one end protruding through his mouth. When he was raised from the pit he presented a terrible appearance. The bar and hat were removed, the latter containing a handful of brains. A physician was summoned, but nothing could be done to save the man's life.

The other unfortunate occurrence took place on the 13th inst., and is described as follows: Michael Hogan fell out of a bucket head foremost down the dark shaft for a distance of ninety feet. He was only engaged at the mine for half a day. As he was being drawn up at six o'clock he grew nervous, lost his hold, and though grabbed by a companion, fell overboard to his death.

The output from these mines has not been so good this month, in consequence of a good deal of dead work in the pits. A fault has been found in the bottom of the main pit which has shifted the phosphate and reduced the production temporarily.



Nova Scotia.

At the annual meeting of the Cumberland Railway and Coal Co., held at Montreal, on the 12th inst., the old board of directors was re-appointed.

At the annual meeting of the Londonderry Iron Company, held at Montreal, on the same date, a report of the operations of the company during the past year was submitted. A dividend of 6% on the preferred stock, payable on 15th March, was declared, and the old board of directors re-elected. At a subsequent meeting of the directors, Mr. A. P. Paterson was appointed president and managing director, Hon. Donald McInnes, vice-president, and Mr. James Phymster, secretary.

The annual meeting of the Black Diamond Coal Co. was held a few days ago. The report of the directors was fairly encouraging. The following were elected directors: D. C. Fraser, Graham Fraser, Geo. F. McKay, J. L. Jennisen and Harvey Graham. The directors recommended the payment of a dividend of 10 per cent. on the nominal capital of the company. The recommendation no doubt was very satisfactory to the shareholders.

We understand that the New Glasgow Iron, Coal and Railway Co. has made a contract with the Stellarton Brick Manufacturing Co. for the supply during this year of 650,000 red brick to be delivered on cars at Pictou Landing. This will insure a good season's work for the brick company, and looks like business on the part of the iron company.

It is reported that the Londonderry Iron Company, owning the Acadia mines, will open and operate the Torbrooke iron mines in connection with its works. These mines are in Annapolis County, N.S., and produce red hematite ore of a very superior quality. The company, it is stated, has secured leases on the property covering about two miles of the ore vein, which is six feet in width, and contains 62 per cent. of metal.

Whiteburn District.

The McGuire mine, to which reference was made in January issue, is reported to be closed for a long time. The Graves mine has made a change of management, Mr. Whidden retiring. The new manager, Mr. W. J. Smart, is an American, and has had an extensive experience in mining in the United States.

Pleasant River District.

Messrs. Thompson & Newcombe have about finished their preparations for active work, and will give their property another test. Larger pumps have been ordered, and will soon be placed.

Molega District.

The Parker-Douglass Co. have received a small diamond drill this week, and intend to use it for prospecting their extensive property. It is intended to bore horizontal holes from the 100 ft. level first, and subsequently to be used for prospecting from the surface. The same company has also on the way an 80 horse-power Rand air compressor, and seven drills, and are considering plans for the transmission of power, either by air or wire rope, from an extensive water power distant about one and a half miles from the mine.

The Caledonia Co. expect to start their mill in a few days. This company is employing a large number of

men and should be one of the largest producers in the camp.

The Malaga Mining Co. are working four of their lodes this month with good prospects, and the product will be large as usual. The company are considering plans for increasing the facilities and output of the mines, and have employed J. E. Hardman, M.E., to consult with Mr. McGuire, the manager, relative to the same.

Oldham District.

The property of the Oldham Gold Co. will be sold, by order of the Court, at Oldham on March 22nd. Little work has been done on this property for some years.

The Standard Gold Company's property, now owned by John Kilhun, Esq., is being prospected by cross-cuts and drifts under ground, and the management hope to reach new pay ground in a few months, or less time.

Fifteen Mile Stream.

The Egerton Gold Mining Company has sold all its property and privileges to a small syndicate, which has appointed J. A. Fraser, of Glasgow, as manager. It is understood that new machinery will be put in at once, and work be vigorously prosecuted this summer.

Central Rawdon.

Manager Willis had the mill running during a part of January, and reports the results as coming fully up to the standard.

Millisigate District.

Work has been recommenced upon a small scale on the property of the Duluth Gold Mining Co. It is of a prospecting character, but the results thus far have been most encouraging.

Beaver Dam.

Work here was discontinued in January for the winter. As soon as the weather will permit, the building of the new stamp mill will be commenced. It is reported that Mr. Turnbull will reside at the mine and manage it, and will also continue the supervision of Mr. North's mine at Renfrew.

New Brunswick.

The treasurer of the Brunswick Manganese Company, to which we referred in our last issue of January, has received advices, according to Boston papers, that a cargo of 200 tons of ore was shipped to Andrew Carnegie, of Pennsylvania, on the 23rd ult. The company has also much more ready for shipment. The reported net profit is some \$11 per ton. Owing to the tides of the Bay of Fundy, shipments are necessarily irregular.

Quebec.

The Villeneuve Mica & Mining Co. expect to have 1,000 tons of their spar ready for shipment in the spring. This spar (orthoclase) is being largely utilized in the manufacture of pottery ware, for which experiments have proved it to be admirably adapted. The shipments last year were purely of an experimental nature, and comprised:

To Trenton, N.J.	171 tons
To England	225 "
To St. Johns, Que.	15 "

Total..... 411 "

Some three tons of uncut mica (muscovite) are now lying in stock.

The asbestos market remains firm; prices range much higher than they have ever done before, and as the demand is undoubtedly greater than the prospective supply even better figures may be looked for during the coming season.

The American Asbestos Co. (Limited), have driven a tunnel from the foot of the hill under their No. 2 and 3 pits, and are now driving a rise to cut the No. 2 pit. The tunnel is 6 x 6 feet, and the rise is being driven in rich asbestos ground. By means of this tunnel they will do away with all pumping, and it will at the same time give them a splendid face or slope to work on. About 150 men and boys are employed.

We are indebted to Mr. Klein, the courteous manager of these mines, for the following official returns of exports and production during 1889:

EXPORTS.		MINED.	
	Tons.		Tons.
No. I.....	51 ¹¹ / ₁₀₀	No. I.....	79 ² / ₁₀₀
No. II.....	68 ⁷ / ₁₀₀	No. II.....	81 ² / ₁₀₀
No. III.....	259 ¹² / ₁₀₀	No. III.....	357 ¹⁵ / ₁₀₀
Hornblende....	2	Hornblende....	12

Total tons.... 381¹/₂ Total tons.... 530¹/₄

Average men and boys employed during year, 60. These mines were first opened last year, and during the

first six months, only hand-work by contract system was in vogue. An excellent equipment of steam working machinery was then introduced, and the results up to date have been most satisfactory.

Messrs. King Bros. contemplate equipping their mines at Thetford with a complete new working plant.

All the machinery of the United Asbestos Company Limited, Black Lake, is now on the ground and nearly ready to run. As soon as the weather becomes a little more settled the management will increase the force, and work the mine on an extensive scale. From returns received from Mr. Frechette, who formerly operated the property, we are informed that the exports to the United States during 1889 were:—

	Tons.
No. 1.....	165½
No. 2.....	62
No. 3.....	132¼
Waste.....	20
Total.....	379¾

Average number of men and boys employed during year about 30.

Prospecting on the property of the Black Lake Mining Co. has developed some very nice veins of asbestos.

The asbestos lots in Coleraine, in which Messrs. Lucke & Mitchell, Sherbrooke, have a part ownership, were merely worked last season with a view to prospecting the property. The surface work was so satisfactory that it has been decided to put in a complete plant early in the spring, and go to work in earnest.

The Geological Survey map of the asbestos region is now in the hands of the engraver, and will be ready for distribution at an early date. The map is a fine piece of work. The difference in the Surveys of some of the Lots, particularly those of the Thetford district, when compared with the Surveys previously executed by the Crown Lands Department at Quebec, show a wide divergence in the location of some of the properties, and we should not be at all surprised to find some lively litigation among the owners as a result. The surveys made under Dr. Ellis, being the most recent, are probably the most accurate.

Capt. Williams will commence operations on the Murphy Lots early in the spring. The exports in 1889 were: To United States, 66½ tons; Canada, 51½ tons. The average men and boys employed were 24 during four month's work.

It is, we believe, the intention of the Anglo-Canadian Co. to equip their property with an additional plant, in order to carry on more extensive operations. A number of new places were prospected last year, and these are sufficiently promising to warrant the addition of steam power to work them. The ground in rear, adjoining the Frechette (now United Co.'s) mine shows equally well, and a large quantity of choice material was obtained from these pits during last year. Mr. R. T. Hopper informs us that the total output from the pits during 1889 was 603 tons, of which about 500 tons went to the United States and the balance to Great Britain.

A further dividend of 10 per cent. is proposed by the board of the Bell's Asbestos Company Limited, making 22½ per cent. for the year 1889. The sum of £1,938 will then remain to be carried forward. We are indebted to Mr. Thos. Sheridan, manager of the company's mines in Canada for the following figures of production during 1889:—

	Tons.
No. 1. Crude.....	1,200
No. 2. do	200
No. 3. do	400
Total	1,800

Mr. W. H. Lambly, of Inverness, did a little preliminary working last year on his property, Lot A, Coleraine. About four months work was done with an average of eight hands, and twenty-three tons were raised.

Official figures received from the company state that the output from the Eustis copper mines during the year ended 31st December last amounted to 34,089 tons of 2,240 lbs. Of this quantity 18,114 tons were smelted, 14,725 tons exported in raw state, and 1,250 tons put in stock. The matte produced comprised 1,773 tons.

Messrs. G. H. Nichols & Co. advise that the production of ore from their Albert mines, Capelton, during the

year ended 31st December, 1889, amounted to 36,000 tons, of which about 25,000 tons were exported,

The Brompton Lake Asbestos Company gives notice of application for Letters Patent of incorporation. The chief place of business of the new company is to be at Quebec; capital \$60,000, in 600 \$100 shares. The names of the applicants are:—E. B. Greenshields, Montreal; Sir Donald Smith, of Montreal; Frederick Stancliffe, Montreal; R. W. Hudson, Bankhall, Liverpool, Eng.; E. J. Hale, commission merchant; Elliot E. Webb, William Cook, Archibald Hay Cook, advocate; G. H. Thomson, Andrew Thomson, president of the Union Bank, Quebec, all of Quebec. The said E. B. Greenshields, Andrew Thomson, A. H. Cook, E. J. Hale, G. H. Thomson to be the first and provisional directors of the company.

Ontario.

A member of the Local Legislature writes to us as follows: "It is expected that the report of the Mining Commission will be ready for distribution during the present session. The Commissioner of Crown Lands has a couple of Bills to amend the mining laws, but neither have as yet been introduced. He tells me that he has some provisions to prevent the taking up by one person for speculative purposes of large areas, but the royalty business he does not feel so sure about."

Reports from the County of Hastings point to a revival of the mining operations in that district. The company that recently purchased the Bull actinolite property is now working with satisfactory results. Rumours are also current that other mines which have long been idle will shortly be worked again by a wealthy syndicate.

Sudbury District.

Dr. E. D. Peters, the well known American metallurgist who has been so eminently successful in the management of the extensive mines and works of the Canadian Copper Co., has resigned to superintend the construction of the new works of the Westinghouse Air Brake Co., Southern Arizona. Dr. Peters is succeeded by Mr. Woodbury, of the celebrated Calumet and Hecla mines, Mich.

At the mines, work goes along very much as usual. No. 2 furnace has shut down for a few days in order to admit some repairs, and No. 1 is now in good running order. The company is at present erecting a school house at Copper Cliff. It is estimated that about 3,500 tons of matte is now in the stock yards.

Mr. Merry, representing the mines operated by Messrs. Vivian & Sons, states that some 90 men are now working in his pits making preparations for an active season's work.

Port Arthur District.

The past month has been unusually encouraging. The continued good fortune accompanying the development of the Beaver mine at great depths by means of the diamond drill, as well as developments at places where the workings are in the cherty formation underlying the Animikie black slates, has demonstrated the fact that this lower formation carries silver veins of great richness. Some of the assays are reported as going about \$700 to the ton. This fact will undoubtedly be the cause of many more prospects being opened up, as numerous minor investors have been holding back pending the result of the operations of others.

In addition to the prosperous condition of the Beaver, Badger, Elgin, Shuniah Weachu and West End mines, another couple of silver prospects are coming fast to the front.

The vein on the "Murillo" property about ten miles west of Port Arthur has widened, and is now producing first-class ore in quantity. This prospect is owned by an English company, who are equipping the mine with all the machinery necessary for rapid and economical working. An English assayer is resident at the mine.

The next aspirant for honours is the "Star" prospect on the west boundary of the township of Strange, about 2½ miles north of Whitefish Lake. There is a large group of promising veins in this locality, and the reported extraordinary richness of the first shaft is attracting much attention and numerous enquiries for lands in the neighbourhood.

The iron land excitement still continues. It is not known what success the engineering party exploring for a branch of the Canadian Pacific railway line to the Atikokan iron has met with. Those best competent to judge predict a very easy route for over four-fifths of the distance.

The iron king of the district, Mr. R. R. Paulson, is building a dépôt for supplies, outfit, etc., at the east end of Arrow Lake to facilitate the development of the immense iron tract which he controls. It is expected that the P. A. D. & W. railway will reach these lands before next fall, as the contractors are displaying unusual energy. The bridge across the Kaministiquia river is just approaching completion, and for about twenty-five miles further the line is dotted with camps of men taking out ties and timbers.

It is reported that the old reliable Rabbit Mountain mine has been bonded to a syndicate, who have guaranteed to spend \$10,000 in a test, and will purchase if development proves favourable.

The Board of Trade at its last meeting discussed the "Torrens" land title system, Hunter's Island lands and local crown lands agencies in mining districts, and appointed experienced men to co-operate with the Bar association in memorializing the Ontario Government to make certain changes highly desirable in outlying mining districts. In the "Torrens" system it would appear that more than four owners cannot be entered against one piece of land. Now when valuable mining discoveries are made it is not unusual to hear of sales of even a fiftieth part, and most people, especially Americans, desire to have a tangible, saleable document, which at present cannot be obtained. The Hunter's Island question is a most annoying one for those who purchased in good faith years ago, and have not received their titles. The want of a title has doubtless caused much loss and worry to the original purchaser, and the Government should take immediate steps to have the ground carefully inspected in order that patents may issue for lands which are in no way valuable for timber. Mining lands open for sale ought to be placed in full charge of the local Crown Lands Agent. It is extremely annoying to have strangers—intending purchasers and explorers—asking day after day what lands are available, and to hear the answer "you will have to write down to Toronto and find out for yourself, and you may get an answer in a week." What is there to prevent the Government placing all saleable lands in the hands of its local agent who is acting under their instructions and can at an hour's notice seek advice from headquarters when in doubt. No money need go into their hands but should be deposited in the bank to the credit of the Government, and a copy of the deposit receipt given to the Crown Lands Agent. This would obviate any possible objections, and any one on arriving here and starting out for the mining region, could go out with a full understanding of what he was about. An explorer or intending purchaser would not be wasting time and money on land which might be already the property of another, and the waste of a week in corresponding with the department would be obviated.

The *Star* has the following comment on the West Beaver property, now on the English Market: "We observe that a fresh attempt is being made to induce the public on this side to purchase what is known as the West Beaver Silver Mine. We are informed that the mine is 'extremely valuable,' and the Beaver mine is being trotted out as being 'in close proximity,' and as having yielded £60,000 in less than two years. No one who knows the facts will wish to dispute that the Beaver is fairly valuable, but there is nothing to show that the West Beaver, or the properties now offered to the public are of value. There is no record of profitable bullion. The Porcupine was opened some years ago, but we have yet to learn that it was done so at a profit. The truth is the promoters of the syndicate are trying to dispose of the West Beaver and other properties on the strength of the Beaver—the one mine which has paid for working."

Now we know little about the merits of the West Beaver, and can therefore say nothing in its favour or against it; but we most emphatically repudiate the statement that "the Beaver is the one mine that has paid for working." The *Star* is apparently very ignorant of the Port Arthur district, and should make itself thoroughly acquainted with the facts before making itself ridiculous by any such untruthful assertion.

The January shipments from the Badger amounted to \$15,000. Its superintendent at present is engaged principally in developing new ground, very little stoping being done.

The Shuniah Weachu Mining Company has driven a drift through an ore body 125 foot long, west from No. 3 shaft. It is all shipping ore, averaging 450 ounces to the ton. A block of ore has been opened up in No. 4 shaft east and west, between the first and second levels, 60 feet deep by 90 feet long. Stoping on both of these ore bodies will be commenced in a few days. The stock of this company is steadily going up in the English market, and the developments at the mine appear to warrant it.

Rat Portage District.

Messrs. Matheson & Chaffee are preparing to resume operations on the Winnipeg Consolidated. The present depth of the shaft is 125 feet.

The new English company formed by Messrs. Taylor Sons to work the Sultana is to commence operations in the spring.

Mr. Oliver Dounais is pushing the development of his claim at Clearwater Bay. He has two shafts down some 100 feet, and has begun cross-cutting.

Man. & N. W. T.

Application for Letters Patent under the "Companies Act" is made on behalf of the Crowfoot Coal Company, Limited; capital stock \$25,000, in \$100 shares. The names of the applicants are:—William A. Allan, Ottawa; Henry LeJeune, Regina; H. E. Secretan, Civil Engineer; A. F. Eden, Land Commissioner, and Heber Archibald, barrister-at-law, the last three named applicants being of Winnipeg. The said William A. Allen, A. F. Eden and Heber Archibald are to be the first or provisional directors of the company.

British Columbia.

It is rumoured that the Island Mountain Company, Cariboo District, will commence working again in the spring. A proposition has been made by Mr. C. D. Rand, of Vancouver, on behalf of some British capitalists, to the owners here of some 23 locations, for the purpose of forming a joint stock company, with a capital of \$300,000, and to commence work by the first of May. All the owners here have signed their consent. It is generally considered that capital is all that is required to make this place one of the richest gold mining centres in the world. If the above-named companies go to work, it will make a change for the better for the whole Province of British Columbia, which is universally acknowledged to be a country possessed of vast mineral resources, awaiting development.

The Nason, of Antler Creek, has again shut down, the pumps not being able to manage the water, and the claim still remains unprospected. The Barker Co., of Williams Creek, is at work running for a spot supposed to be left from old times.

Everything in the mining line looks better and more encouraging at this moment than has been the case in many years back. We are all hopeful and in the best of spirits. The cold weather has again set in, the thermometer registering at the time of writing below zero. Yet it is dry and bracing.

A proposal is on foot to form a syndicate with \$300,000 to develop the property of the B. C. Milling & Mining Co. Messrs. John Taylor & Sons, London, Eng., are interested in the venture.

The four mines at Field, which were part of the assets of the defunct British Columbia Smelting Co., were sold at public auction a few days ago by Sheriff Bedgrave, and were bought in by the Vancouver Syndicate for about \$7,500. These mines, and property in connection, cost the old company in the neighborhood of \$80,000. Mr. Ceperley has gone up to Field as the representative of the Vancouver Syndicate.

Application was made some time ago by the Government of British Columbia for a remission of customs duties on certain mining machinery imported by the Government, and entered at the port of Vancouver. The reply of the Department was that a remission would be granted if it could be shown that similar machinery was not being manufactured in Canada. Among the articles imported was a No. 2 Kendal quartz mill, which is made only in the United States; but as the British Columbia Government has failed to place a distinct value on the mill, and the invoice being a bulk one for mill, engine, boiler, pan, settler, etc., it was impossible to arrive at the amount of duty to be remitted, and accordingly the application has been refused.

We regret very much to have to record the complete destruction by fire, on the 4th inst., of the new Reduction works at Barkerville; loss \$25,000. These works were established in the centre of the Cariboo mining district by the Local Government last summer for the purpose of testing British Columbia ores. They were completed in November, and the operations were very successful. Their destruction by fire is a severe blow to mining prospects, which were looking very bright, owing to the interest taken in the development by English capitalists. It is thought the Government will re-build at once.

D. W. A. Hendryx, manager of the Kootenay Mining and Smelting Company, writes that his brother is in negotiation for the purchase of the Silver King, Kootenay, Bonanza and American Flag mines, the property of the Hall Bros. and others, and located on Toad Mountain, near Nelson.

The Phosphate Trust.

The Phosphate Trust, to which a reference has been made in these columns, has, we understand, been withdrawn in its original form, and it is now said that the proposal will be submitted on a more modified basis. Below we publish extracts from some of the English financial papers commenting upon the Trust and also communications from readers of the REVIEW upon the subject:

A gentleman prominent in the trade writes:—"On Tuesday Mr. ——— told me that our Ottawa County lands are included in the scheme. I gave an offer of these lands to a Montreal lawyer last February for four months, and from what Mr. ——— tells me I infer that his agents must have taken this liberty, although the matter was wholly withdrawn from them last June. I should like very much to see what they have done, and would like to put my people on their track. It is consummate cheek; but nothing surprises me now on the part of a London company promoter.

The *Star* says: "Our well informed contemporary, the CANADIAN MINING REVIEW has received a very remarkable document which purports to be the prospectus of a new concern on the eve of being submitted to the English public under the pretentious title of the Phosphate Trust (Limited)." * * * * *

Our contemporary warns the public against having anything to do with the venture. We repeat the warning. It is not the only one of its kind coming from the same quarter.

The *Financial Times* quotes the REVIEW's article *verbatim*.

"A well-known firm of English chemical brokers and phosphate merchants writes: "We have read and are very much in accord with the remarks in the December number of your REVIEW about the late proposed syndicate for the purchase of Canadian phosphate lands. If any sales had really been carried through on the basis of such figures, the industry could only have been discredited. Well selected lands have a solid value, which we expect will improve."

Another gentleman, well known in London, and intimately associated with the trade, differs from our views in the following terms: "I read with great interest your very able article on 'Phosphates' in the December number, in which you advocate large working capital, the want of which has always been the drawback of Canadian phosphate mining. You further state that large operations are essential to success, and that you hope to see soon a large amount of capital put into the working of these mines. With all this I thoroughly agree. Turning over a few pages, however, I see you go for the proposed Trust. I take it from the opening comments that you had no time to study the "private and confidential" document put before you, or you would have noticed that the essence of the scheme was to get a large sum of money to work the Canadian phosphate deposits, and, further, that 'every property will be separately examined and selected by the company's experts, etc., before being acquired.' Now, the way this scheme has come about was as follows: Dozens of properties were being hawked round in all quarters, and had, say, ten of them been floated, the capital would have most probably exceeded that of the proposed Trust, and there would have been attempts to float some twenty or so more. Now, instead of this having taken place, which would have been a misfortune to the industry, increasing competition in all ways, in the buying of provisions, machinery, etc., and on the other hand, in the selling of the ore, the present scheme seeks to combine a very large number of properties and work them all as one undertaking. The company does not bind itself to acquire the properties offered to it, nor does it follow, as your comments suggest, that, because a property is unknown to you, or to me, or to C, D or E, it is *ipso facto* worthless. Of course the final success of the scheme depends on the management, but I think the idea is a sound one, and I very much regret that you criticised our rough advanced prospectus, marked "private and confidential," in a manner apparently very hurried. Should this scheme not go through, I think it will throw back Canadian phosphate again and make it next to impossible to get any capital put into the industry."

A Montreal firm extensively interested in the mines, and the largest exporters of the mineral last year, have expressed their views in the following terms:

"In the first place, the name of the company, as a "Phosphate Trust," would certainly tend to deceive the public, as a Phosphate "Trust" would intimate that the promoters held at least the "balance of power" in the Canadian phosphate business, whilst if you look into the properties they propose to hold, you will hardly find one of any great importance, and all the actual phosphate producing properties are in other hands. Leaving aside the right of the "Trust" to bring forward a great many properties without the actual consent of the owners, we consider the scheme as by far too gigantic, and we doubt whether anybody with an intimate knowledge of the Canadian phosphate deposits would wish to invest money therein. The taxes on the nominal capital stock of such a company would in themselves constitute a good dividend for any reasonable company.

Curious Occurrence of Lightning in a Scotch Colliery.

Drumsmudden colliery is near to the Ayr and Muirkirk railway, 1½ miles above Dronagan station, and consists of two pits, each 200 fathoms deep, and forty yards apart, having a large pumping engine and coupled winding engines, both under the one roof, and built on a stone seat. The height of the chimney is 120 feet, and it is fitted with a lightning conductor, made of copper ¾ inch diameter, about 5 feet long, with copper wire ¾ in. diameter attached. The pumping pit is 10 yards from the boiler stalk, and has a pithead frame 40 feet high, over which two pulleys are fixed, guiding the haulage ropes to the pit bottom. There is also a Guibal exhaust fan connected with this pit. On Wednesday morning, 21st November, 1888, a thunderstorm of unusual and alarming severity burst overhead, and a flash took place at a time when the ascending cage was within 20 yards from the surface. The engine man was made powerless by the electricity, but, fortunately, had the presence of mind to throw himself on the brake lever, and stop the engine. When he recovered, he felt pained in the arms, neck and shoulders. Probably the fluid ran along the beam of the pumping engine, then down the steam pipes which are connected to the winding engine, and along which it would find its way to the throttle valve handle. A heavy charge descended the conductor on the stalk uplifting the earth and ashes at the bottom, but otherwise doing no damage. The pit bottomer of the winding pit heard a loud, cracking noise, and saw a clear bluish flame on the crowns on the roof at the pumping pit. The signal boy was terrified, seeing fire running and leaping between the haulage rope and the rails. The chainman was engaged at the time taking down the empty race, and was sitting on the last hutch, with his feet on the chain. When about 40 yards down he felt a shock through his legs, and was pitched down on to the road, and lay stunned for a time. Twenty yards beyond the foot of the slope dock, or 320 yards from the pumping pit bottom, and 240 fathoms from the surface, two boys were standing, one having his feet on the rails and his head almost touching the electric bell wires. He got a shock turning him round about, and both were terrified by seeing fire flying between the rails and wire. They ran off to find the oversman. When they found him they were white with fear, and said fire was flying all through the pit. Fortunately no serious injury was done to any of the workmen or property by the above strange occurrence.

Refining Gold at the Australian Mints.—The process employed in refining gold at the Australian Mints, according to the *London Mining Journal*, is different from that resorted to at the British Mint. It seems in Australia that when gold is melted in the crucibles, which are first heated to a dead-red, borax is placed upon the metal in a melted state, then chlorine gas is passed through a pipe, which is gradually depressed until it reaches the bottom, and when the compressor is relaxed, so that the gas bubbles up through the gold in its molten state, but without causing the projection of any globules. Hydrochloric acid from time to time is also introduced into the generator, and by this means a rapid evolution of chlorine is kept up. When the gas first passes into the gold, fumes escape from the holes in the crucibles. These consist only of the chlorides of inferior metals that are attached to the valuable ones, none of the chloride of silver escaping. When any silver remains in the gold nearly the whole of the chlorine continues to be absorbed; afterwards, when the refining is nearly completed fumes of a darker colour make their appearance, and the end of the operation is indicated by the flame or luminous vapour appearing first of a bright yellow colour, and gradually growing into a deep, reddish brown. The value of chlorine in gold refining is certainly not a novelty, but it is claimed it has not before been put into practical use, though its action on gold has been no secret to chemists, for it does not mix with it at a red heat.

10,000 Egyptian Cats: Sale of a Curious Cargo of Very Ancient Manure.

Messrs. Leventon & Co., of Liverpool, received the other day a consignment of 19½ tons of embalmed cats from Beni Hassan, Central Egypt. In this parcel are the remains of about 180,000 cats. Specimens of these have been placed in the Liverpool Museum. Messrs. Leventon & Co. are about to employ them as manure, and a correspondent writes: "Last week a most interesting auction was held, in a large Liverpool broker's office—namely, twenty tons of cats. To understand what they are, it is necessary to know something of ancient history. It is well known that many nations, in prehistoric times, adopted the religion of totemism, believing that there was a relationship between man and the bird, beast or reptile which he particularly fancied. The totem of the ancient Egyptians was the cat, hence when a cat died it was gaily buried with all honors—being embalmed, sometimes decorated, and, in short, had as much attention paid as any human being. It had been long suspected that a cat cemetery existed on the east bank of the Nile, and in the autumn of 1889 a lucky Egyptian found this ancient burial ground at Beni Hassan, about 100 miles from Cairo. Laborers were soon at work, and dug out hundreds of thousands of cats. Some were quickly sold to local farmers, and the bigger lots and their way to an Alexandrian merchant—then, by the steamers Pharos and Thebes, to Liverpool, where they were knocked down at £3 13s 9d per ton to a local utiliser merchant. The auction was only known to the trade, but even the 'bone' buyers looked nervously at the large samples exposed, the genial broker knocking the lot down with one of the pussies' heads for a hammer.

Hoisting Machinery.*

(By William Giliie.)

In this day of progress and improvement, one is struck by the rapid developments that have taken place, and the new improvements that have been introduced for the purpose of raising the mineral from the mines. A good many steps of improvement intervene between the crude methods of slowly winding up small quantities of coal, for centuries ago, and the rapid, well-disciplined traction of the present day. The ingenuity of man is always been equal to the wants and requirements of time; and in no other way has his genius been more tested, than in that of devising methods for raising the mineral from the mines.

Our subject brings to our attention the names of such men as Savoury, Newcomen and Watt. In 1698 Thomas Savoury invented an engine to pump water from the mines, for which a patent was granted, it being known as the "Miners' Friend." The steam was used to produce a vacuum, and the pressure of the atmosphere was depended upon to raise the water in the pumps.

Thomas Newcomen, about the same time, was busily engaged upon his atmospheric engine, and the results, though rude and imperfect, were far in advance of anything of his time. The atmospheric engine grew rapidly in favour, and was extensively used by mine-owners, who did not like Savoury's engine. Newcomen's was an atmospheric engine because it depended on the pressure of the atmosphere to perform the downward stroke, and do the principal part of the work. Its great disadvantage was, that the cylinder was required to be hot one time and cold at another, thus the fresh steam heated a cold, wet cylinder, thereby losing three-fourths of its power. This wasteful expenditure of steam continued until James Watt, the renowned engineer, having made a model of the atmospheric engine to repair, saw the great defect of the engine, and at once went to work to solve the problem of a separate condenser. In this he succeeded, and to him belongs the honour of having introduced all the leading principles of the steam engine as we have it now.

Mr. C. M. Percy, in his Mechanical Engineering of Collieries, lays down the following conditions, which every good winding-engine should fulfil: They should be strong, durable, and comparatively light in construction, with more power than is necessary for the maximum amount of work to be done, easy to handle and reverse, quick to start and stop, and capable of reaching their highest rate of speed in a short time; also, they should work in pairs and be so proportioned that in case of a break-down with one engine, the other would be capable of raising the load, although slowly.

Modern hoisting-engines possess all of these requirements, except economy in the well-known horizontal, direct-acting, high-pressure, non-condensing engine.

This question of economy did not matter so much when mining was in its infancy, when shafts were shallow and the products of the mines had to be conveyed but a short distance; but with the great and rapid development of the mining industry, and the fierce rivalry and competition that is now existing, economy is one of the most important points to be considered. Engines work-

ing without expansion and without condensation, are of the most extravagant class, for with non-condensation one-third of the absolute pressure exercises no effective pressure at all, and with non-expansion more steam is required for the same amount of work, than if the engine worked expansively. For, when steam is admitted to the cylinder at a high-pressure the piston attains a great initial velocity, and before the stroke is completed the steam is cut off, the rest of the stroke being completed by the elastic force of the steam already in the cylinder. The steam expands as the piston moves forward, and consequently, its pressure is in conformity with the law of Mariotte's and Boyle, until the piston is at the end of the stroke, thus a great saving in steam is effected, and, as a consequence, a smaller amount of coal is required, and a maximum amount of work is obtained from a minimum amount of steam. If we wish to find the pressure of steam at any point in the stroke, when the engine is working by expansion, and an indicator diagram cannot be taken, we can find it by the following rule:—

Let us suppose that steam is admitted into a cylinder 6' long, at 60 lbs. pressure, and the steam is cut off when 2' of the stroke has been performed.

The pressure during 1st foot of stroke is.....	60 lbs.
The pressure during 2d foot of stroke is.....	60 lbs.
The pressure during 3d foot of stroke is.....	$2/3 \times 60 = 40$ lbs.
The pressure during 4th foot of stroke is.....	$2/4 \times 60 = 30$ lbs.
The pressure during 5th foot of stroke is.....	$2/5 \times 60 = 24$ lbs.
The pressure during 6th foot of stroke is.....	$2/6 \times 60 = 20$ lbs.

Total pressure..... 234 lbs.

Dividing this total pressure, 234 lbs., by 6, the number of ordinates taken, gives an average pressure in the cylinder of 39 lbs., the terminal pressure being 20 lbs.

The great difficulty in applying expansion-gear to hoisting-engines is, that we want full power all through the stroke, and during the changing at the top and bottom of the shaft. Little has been done toward making our winding-engines work by expansion, and while this economic principle has been applied to all other classes of engines, scarcely one per cent. of winding-engines have any such arrangement. We hope that mechanical engineers will soon see the utility of applying some automatic arrangement, making the hoisting-engine as economical as that of any other class.

The work performed by a hoisting-engine is the lbs. of coal raised through any given height, i. e., if 2 tons are lifted from a shaft 600' deep in one minute, the useful work will be equal to $2 \times 2,000 \times 600 = 2,400,000$ units of work, or foot lbs., and $2,400,000 \div 33,000 = 72.73$ horse-power. This work is termed the useful horse-power, without allowing for friction of machinery, etc. Work may be defined as the combination of force and motion. The unit of work is one pound lifted a distance of one foot. While power may be defined as the speed of doing work, the unit of power is a force of one pound put through a space of one foot in one minute. A horse-power is equal to 33,000 units of power. The actual or indicated horse-power is the amount of power that is being exerted by the engine, and includes all resistances such as the moving parts of the engine. The indicated horse-power is found by multiplying the average effective-pressure by the area of the cylinder in square inches, and this by the mean speed of the piston in feet per minute, which gives the units of power; and this divided by 33,000 will give the horse-power of the engine. To illustrate, suppose we have an engine with an effective-pressure of 40 lbs. per square inch, acting on a cylinder 30" in diameter, the speed of piston being 200' per minute. The units of power will be $30 \times 30 \times .7854 = 706.86$ area of cylinder, and this, multiplied by the pressure, which is 40 lbs., and the result multiplied by the speed of the piston, 200' per minute, will give the units of power or 5,654,880, and this divided by 33,000 equals 171.36, the indicated horse-power. The average effective-pressure is the difference of pressure between the fresh steam that is entering to force the piston down, and the exhaust-steam that has a tendency to prevent the piston from being driven down. Mr. Percy, in solving questions like the above, allows 50% for resistances, and as the work to be done by a hoisting-engine is not continuous, it is best to have a sufficient margin of power under all conditions.

The modulus of an engine is that fraction, which expresses the ratio of the work done to the power applied. If the work applied to an engine equals 60 horse-power and the engine only delivers 40 horse-power, then $\frac{40}{60} = \frac{2}{3}$ modulus, $\frac{1}{3}$ of the power applied is lost in friction in the moving parts of the machine.

We can ascertain the pressure of steam, and the diameter of the hoisting-drum, when the load is specified, the time of a winding given, with the length of stroke and area of cylinder. For example: If the diameter of

a cylinder is 20", the speed of the piston 360 feet per minute, length of stroke 5 feet, and the time of hoisting from a shaft 720 feet deep, is 40 seconds.

Then, $\frac{360 \times 40}{60} = 240$ feet distance travelled by the

piston in 40 seconds of time, and as the piston makes a forward and backward stroke at each revolution of the drum, the distance travelled in one revolution would be 10 feet. The revolutions a drum would make during a winding would be 240 divided by 10 or 24, and as the shaft is 720 feet deep, $720 \div 24 = 30$ feet circumference of drum, and $30 \div 3.1416 = 9.5$ feet the diameter of drum. If 2 tons or 4,000 lbs. are to be lifted in the load, then $4,000 \times 30 = 120,000$ lbs. the moments that are acting on the drum, and as the diameter of the cylinder is 20", the area will be $20^2 \times .7854 = 314$ area of cylinder, this multiplied by 10 feet, the distance travelled by the piston during one revolution of the drum, equals 3140. The number of pounds that are acting on the drum $120,000 \div 3,140 = 38$ lbs. pressure of steam that must be applied to the cylinder per square inch, adding 17 lbs. for resistances the total pressure would be 55 lbs. per square inch.

In connection with hoisting-engines various methods have been adopted for the purpose of counterbalancing the load, which I will briefly notice here. The chain and staple are being replaced by more modern methods. The incline counterbalance is used to some extent, the counterbalance force may be found by multiplying the weight of the counterbalance by the height of the incline and dividing the result by the length of the incline. The tail-rope counterbalance consists of a rope the same size as the hoisting-rope passed around a sheave at the bottom of the shaft, the pulley being free to move upwards or downwards between guides. The Koepe system does away with the winding-drum and substitutes a sheave connected with the engine. There is a return sheave placed at the bottom of the shaft. Two ropes are used, one connected with the tops of the cages passing around the sheave that is used instead of a drum. The other is attached to the bottom of the cages passing around the sheave in the sump. The advantage claimed for this system is, that it gives a perfect counterbalance in all parts of the winding; smaller engines are required as well as engine-rooms and no drum is necessary.

The conical drum is fast coming into favor, as the load is uniform throughout the hoisting, the full cage at the bottom of the shaft being attached to the small diameter of the drum, and the empty cage at the top of the shaft to the large diameter, so that the principle of the drum is, that a heavy weight, when acting on the short arm of the lever, is equal to a lighter weight applied on the long arm.

Everything in connection with a hoisting-engine should be kept in good order, so that the friction of the machine will be reduced as much as possible, and the guides in the shafts should be kept well greased, thus increasing the amount of work.

The Mining Industries of Eastern Quebec.

(By R. W. Ellis, L.L.D., Geological Survey of Canada.)

That portion of Quebec to which the few remarks I propose to make are more particularly intended to apply, viz., the Eastern Townships, has long been known for its mineral wealth, and has enjoyed a reputation for mining enterprises, second probably to no other part of Canada. Capital has been invested in large amounts at various points, some of which has yielded a handsome return to the investors, while in other cases the inevitable results of rash and foolish speculation have followed, much good money has been sent after bad, and the principal result has been a dearly bought experience. This is a peculiarity which, I take it, is not entirely confined to Canada, and it can safely be said that this portion of Quebec does present to-day more advantageous openings for the investment of capital, wisely and skillfully applied, probably, than at any stage of its past history. It may be said, generally speaking that these industries are at present confined to not more than half a dozen lines, among which may be enumerated, in the order of their present value, copper, asbestos, roofing and other slates, gold, and the manufacture of lime. Silver, chromic-iron, antimony, nickel and the various ores of iron, have also been worked to some extent.

The relations between the geological structure of any country and its mineral wealth are very close and of the highest importance, but while, as officers of the Geological Survey, possibly the greater part of our energies have been devoted to the unravelling of the complicated problems of structure which have from time to time been presented in regard to the age of the several rock formations in Canada, a certain amount of attention has always been paid to the careful study of the economic aspect of the question. Some of the most intricate problems of geological structure have been encountered in that section of Quebec east of the St. Lawrence River,

*Read at the Ottawa meeting of the American Institute of Mining Engineers.

upon the elucidation of which much labor has been expended for more than forty years. It is no great cause of wonder, therefore, that changes of opinion have taken place concerning the age of certain portions, as new light has been presented by successive years of study.

To better understand the positions of the several mineral-bearing zones of eastern Quebec, it may briefly be stated that the rocks of that section are divisible into three grand classes, viz.: the crystalline schists, which occur in the form of extended anticlinal ridges, the slates and sandstones, often highly quartzose, which flank these ridges on either side, and the areas of volcanic rocks, diorites, granites, serpentines, etc., often of large extent, with which both the preceding divisions are intimately associated. As to their age, the views of those who have more recently studied these rocks differ widely from those expressed in the earlier publications of the Geological Survey. Instead of now regarding the great ridges of crystalline schists as altered Middle or Lower Silurian sediments, it has been very conclusively established, both from palæontological and stratigraphical evidence, that they are much older, being, in fact, for the most part, at least, pre-Cambrian, by which is meant that they underlie the lowest known fossiliferous Cambrian zone. In the same way much of what was forty years ago regarded as Upper Silurian, in which was included a very large area in the southeastern portion of the province, has been found to really belong to the Cambrian and Cambro-Silurian systems. In this way a connection has been established with well-recognized mineral-bearing zones of other provinces and countries, in places where formerly a marked discrepancy in the relations of the rock formations was apparently presented.

As regards the geological position of the principal mineral-deposits of this section, we now find that the ores of copper, where found in workable quantity, are very largely confined to the areas of the crystalline or older schists. Deposits of considerable extent, it is true, are found at other horizons, more especially in connection with masses of dioritic rocks, but as a rule these have not, in so far as yet worked, proved very continuous or of marked value.

On the other hand, the asbestos, or, more properly speaking, chrysotile, occurs in serpentine rocks which are for the most part associated with the Cambrian slates and quartzose sandstones, although serpentinous rocks are found along with the schists at certain points. The roofing slates, at one time regarded as of Upper Silurian age, are also now held to form part of the great Cambrian series, as is also the case, I believe, with the slates of the Welsh quarries, while the gold, the mining of which has, however, as yet been entirely confined to the alluvial deposits, or to the gravels of old river channels, is also without doubt in great part derived from quartz-veins in slates of the same Cambrian age. The statement as to the age of this last is important, from the fact that these slates were for many years regarded also as of Upper Silurian age, and have been so described in the *Geology of Canada*, 1863, in which the earliest views of the Survey as to the structure of this region, viz., those of 1847, are simply repeated. The resemblance of these gold-bearing slates, which are especially developed in the Chaudière and Ditton areas, to those of the Cambrian gold series of Nova Scotia was, however, pointed out many years ago, and referred to by Logan, Selwyn, Hunt and others.

The copper-deposits in Eastern Quebec, operated for many years, and still worked, are those known as the Capelton mines. They are situated about seven miles south of Sherbrooke, the principal city of Quebec, east of the St. Lawrence, and are located on the eastern flank of a ridge of talcose, chloritic and micaceous schists, which in this locality form a somewhat narrow belt, some miles in extent. It has, in the late reports, been described as the second or Sherbrooke anticlinal. Throughout this belt of schists, with which are associated considerable masses of greenstone or dioritic rock, deposits or veins of the sulphuret or copper pyrites are numerous; and a few years ago, at the time of the great copper boom, a number of mines were opened in this section. While at many of these places the veins promised well at the time, the gradual decline in the price of copper, and the generally low grade of the ore, rarely yielding more than four to seven per cent., resulted in a gradual suspension of most of these enterprises. At the present time, while prospecting is again being resumed with some vigor, mining is confined almost entirely to two locations at Capelton, viz., the Nichols and the Eustis mines. The continued success of these workings has been due to several causes. One, probably, is the great size of the vein, which is stated to reach, in places, a thickness of 45 to 60 feet, and has been worked to a depth of over 1,500 feet. A chief cause, however, is that these ores are rich in sulphur, the bulk of the raw ore being used, first of all, for the manufacture of sulphuric acid, the residue being subsequently utilized for the extraction of the copper. A certain percentage of silver in the ore is also, doubtless, a very important factor as regards their present successful working, the amount at times ranging as high as 10 to 12 ounces to the ton, and probably even

higher, though probably 3 to 4 ounces represent the average.

The output of ore from these mines is large, ranging from 30,000 to 40,000 tons per year for each. While the greater part of this product is shipped in the raw state, smelting works, recently repaired by the Eustis Company, now dispose of over 1,000 tons per month, which is reduced to matte on the spot. At the Nichols mine adjoining, a correspondingly large amount is used for the manufacture of acid. A portion of the latter, with the phosphate of the Ottawa Valley, is converted into superphosphate of lime. This industry, in the not distant future, bids fair to assume very large proportions. At the smelting works of the Eustis mine, the large percentage of sulphur is, at present, burned off and lost.

The larger lodes of copper-ore at these places appear to be mostly in the form of the yellow sulphuret or chalcopryite, with which is found a very large percentage of iron pyrite. These have their largest development in the townships of Bolton, Hatley and Ascot, though in some of the mines formerly worked, for instance, in the old Huntington mine, a large proportion of the pyrite is the magnetic variety or pyrrhoite. The rocks associated with these ores are, for the most part, schists of various kinds, with diorites and sometimes serpentine. Variegated and virtuous ores are also found, in considerable quantity, in the more westerly belt of Acton, Halifax and Leeds, where they have been worked to a very considerable extent. These are frequently associated with nacreous or talcose schists, as at the Harvey Hill, or with limestones, slates and trappean rocks, as at Acton. At both of these localities very extensive workings have been carried on, and a large amount of very rich ore has been extracted. The mines of Harvey Hill are again being operated under a new management, the new company being styled the Excelsior Mining Company.

A very full description of the character and distribution of the various copper deposits of the eastern townships is given in the latter portion of the *Geology of Canada*, 1863, pp. 709-736, and supplemented in the general report, 1866, pp. 34-44. From these it will be seen that many localities exist in this area other than those just mentioned, which are really deserving of careful attention at the present time as a source of supply for copper, both for smelting purposes and for the manufacture of sulphuric acid. The great and present value, however, of the copper deposits above indicated is more particularly due to the fact that, in the more easterly or Ascot belt, the veins of pyrites which are without doubt in many places, of great extent, contain a very large percentage of sulphur, rivalling, in this respect, most of those yet known to occur in the copper-bearing belts of the Atlantic portion of the adjoining States. Their great importance as a source of supply for ores suitable for the manufacture of acid is just now beginning to be fully realized. It is, presumably not too much to say, that within the next five or ten years, great developments in this respect will take place throughout this section.

In the belt of crystalline schists, both to the north and south of Sherbrooke, recent developments indicate that possibly the heaviest and richest ore veins have not yet been reached; and, in view of the new conditions which have arisen, much of this district would repay careful prospecting. Further to the north again, in Ascot and Garthby, new developments are at present being made that promise fine returns, and bid fair to equal, if indeed they do not surpass, the well-known mines of Capelton.

The asbestos industry, although of comparatively recent date, has since its inception in 1878, rapidly increased in importance, and bids fair to speedily become the leading mining industry of the province. While the occurrence of fibrous serpentine or chrysotile in the Townships has been known for many years, and has been mentioned in the earlier reports of the Geological Survey, its true economic importance remained unrecognized, and it was not until the opening of the Quebec Central Railway across the serpentine belt of Thetford and Coleraine that any importance was attached to this peculiar mineral. Although occurring to some extent with the serpentines of the Laurentian district, north of the Ottawa River, its direction in this extent has not as yet been sufficiently studied to warrant a clear expression of opinion as to the actual value of these areas, and the production of asbestos or chrysotile is as yet entirely confined in Canada to the Eastern Townships, and to the serpentine rocks which are at present regarded as forming a part of the volcanic belt of the lower Cambrian system of Quebec.

This mineral differs entirely from the actinolite of central Ontario, and the asbestos of the Township also presents several points of difference when contrasted with that from the Laurentian district. This is seen in the greater softness, silkiness and tenacity of the fibre of much of the former, a property which gives it great value for spinning and for its working into the finer variety of textures to which it is now so extensively applied.

The stratified rocks associated with the serpentines of the townships in which the workable asbestos occurs are

generally slates of various colours, black, gray, green and purple, with occasionally conglomerate and sandstones, which are often hard and highly quartzose. These are frequently associated with diorites, which often form large mountain masses as at Orford, Ham, Broughton and other points, and which in texture are generally fine-grained, both massive and concretionary, and in colour, range through shades of green to brown.

In the province of Quebec the serpentines extend for many miles, in a series of interrupted outcrops from the boundary of Vermont, nearly to the extremity of the Gaspé peninsula. At several places, notably at Thetford and Coleraine, and in the Shickshock mountain-range of Gaspé it presents a large development. It is sometimes found in bands of a few yards in breadth, apparently interstratified with the slates and sandstones, and sometimes with diorites, in conjunction with which it forms knoll-like hills or elongated ridges of considerable extent. In many places a gradual transition from the diorites to the serpentines can be observed, and it seems very conclusively settled, both from observation in the field on a large scale, and from analyses in the laboratory of the Survey, that much of the serpentine is an alteration product from dioritic rocks, rich in olivine or some allied mineral. While generally massive, the rock has at times a slaty structure, and in many localities the mass is much shattered and broken. More especially is this latter feature noticeable in quarries or areas where dykes of diorite but more generally of a whitish granite or granulate, cut the serpentine. This latter rock, which has generally a grayish or grayish-white color, consists for the most part of orthoclase feldspar and quartz, but at times contains an admixture of mica, classing with a true granite. Whatever may be the age of these whitish dykes, which frequently become masses of considerable extent, they certainly are newer than the serpentines, which they traverse, as is evidenced clearly by the alteration and shattering of the mass traversed along the contact. The view is held by many of those engaged in mining asbestos, that the presence of these smaller dykes exercises a favorable influence on the production and character of the veins, in the same way as the action of diorite dykes upon copper or other metalliferous strata on the production of ore deposits.

Among the principal areas of serpentine which are found at so many widely scattered points, the most easterly yet known is at a point called Mount Serpentine, about ten miles up the Dartmouth River from its outlet in Gaspé Basin. The serpentine is here associated with limestone and surrounded by strata of Devonian age. Small veins of asbestos are found in the rock, but not yet in quantity sufficient to be economically valuable. West of this the next observed is the great mass of Mount Albert, whence it extends west in a great ridge for some miles. This mass is known to contain veins of chromic iron, and traces of asbestos have also been observed, but the area has never yet been carefully explored with a view to ascertain the presence of the mineral in quantity, owing largely to the present difficulty of access.

In Cranbourne and Ware, to the north of the Chaudière River and in the vicinity of that stream between the villages of St. Joseph and St. Francis, several small knolls are seen, in all of which small and irregular veins are visible, but apparently not in quantity sufficient to render them economically important, at least in so far as yet examined. Further to the southwest, in Broughton, Thetford, Coleraine, Wolfestown and Ham, a very great development of these rocks is observed, forming at times mountain-masses from 600 to 900 feet above the surrounding country level, and presenting very peculiar and boldly marked features in the landscape by their rugged outlines and curiously weathered surfaces. The large areas of this division terminate southward at a point termed Ham Mountain, a very prominent peak of diorite which marks the extremity of the ridge. In this great area, which we may style the central area, asbestos can be found at many points in small quantity, but at a comparatively few does it occur in quantity and quality sufficient to warrant the expenditure of much capital in its extraction.

The third area, regarding that of the Shickshocks as the first, begins near the village of Danville, and may be styled the southwestern area. Thence it extends through Melbourne, Brompton, Orford, Bolton and Potton, in a series of disconnected hills, to the American boundary, beyond which the continuation of the serpentines can be traced into Vermont. In these areas, with the exception of the peculiar isolated knoll near Danville, the asbestos has, as yet, been observed in small quantity only, and generally of inferior quality. Large areas of soapstone are found at points throughout the area, and the associated diorites have a large development. It must, however, be said of this section, that considerable areas, whose outcrops can be seen along the roads which traverse the district, are concealed by a dense forest growth, and the true value of such portions must, for some considerable time, be largely conjectural. In fact, until the forest and soil are completely removed by the action of forest fires, as was the case at Black Lake and

Thetford, the search for asbestos is likely to prove difficult and unsatisfactory. It is, however, very evident from the studies already made on this interesting group of rocks in Canada, that all serpentines are not equally productive—a fact very evident even in the heart of the great mining centres themselves, where large areas of the belt are made up of what is known as barren serpentine. As a general rule, however, the rock likely to prove asbestos-producing can be determined by certain peculiarities of texture, color or weathering.

At the Thetford mines, and in that portion of Coleraine lying to the northeast of Black Lake, certain conditions favorable to the production of asbestos appear to have prevailed, and have led to the formation of numerous veins, often of large size, which, in places, interlace the rock in all directions. These veins range in size from small threads to a width of 3 to 4 inches, and in rare cases even reach a thickness of over 6 inches. The quality of the fibre, however, varies even in these localities, and while much of it is soft, fine and silky, other portions are characterized by a harshness or stiffness which detracts greatly from its commercial value.

Several theories have been put forth as to the origin of the asbestos veins. From a careful study of many places throughout the belt, it would seem that the theory of segregation applies equally to these as to quartz veins or other mineral lodes. The fibre of the veins, unless distorted by pressure, is always found at right angles to the sides of the fissure, and frequently in veins of what are regarded as of large size, say from two and a half to four inches, the continuity of the fibre is broken by a dividing zone or comb, if one may use the expression, of grains of magnetic or chromic-iron. In certain cases, also, the mass of the serpentine appears to lose color near the veins or in immediate contact with them, but this feature is not always observed.

The fissures or veins are not always regular or persistent for any very great extent. A small vein at the surface, of half an inch in thickness, may quickly enlarge to one of three inches or more, and, continuing, may die out entirely, while others come in on either side. They have much the aspect of gash veins in slaty rocks, though many instances are seen where the fibre maintains a tolerably uniform size for considerable distances.

The containing rocks show the presence of numerous faults, as in other mineral localities, but possibly in the serpentine these are often more plainly marked. These faults throw the veins from side to side, and frequently are of sufficient extent to cut off entirely the working face of a highly productive area, the rock on the other side of the fissure being often entirely barren. The sides of the fault, in such cases, show extensive slickensides, and frequently have great sheets of coarse or woody-fibred, or imperfect asbestos, along the planes of fracture. Occasionally, pockets or small veins of chromic-iron are found in close proximity to the asbestos.

Much of the asbestos found at the surface, or in the upper workings, is discolored. This is generally the case where the rock is shattered by the action of the intrusive dykes, or from some other cause, and the coloring is doubtless due to infiltration of water along the lines of jointing or fracture, becoming less as the rock grows more solid. The quality of the fibre in such cases improves as the mine becomes deeper. A somewhat similar remark may be made as to the quality of the fibre at the surface as compared with that from a lower level, but proceeding from a different cause. Owing to the destruction of the forest over the serpentine knolls by extensive fires or by the action of the weather, the asbestos veins, which are exposed at the surface, have frequently a certain amount of harshness, which entirely disappears as the vein is opened. This peculiarity is probably due to the action of the fire, by which a certain proportion of the contained water of the mineral is dissipated; and in this connection, also, a very interesting study is afforded by the comparison of the output at the Thetford mines with that from certain areas in the Black Lake district. At the former, the fibre is remarkable for its soft, silky character, and the percentage of harsh fibre is comparatively small. The same is true of certain of the Black Lake mines, but at others, though many veins of good size are also found, a very much larger proportion of the fibre is harsh or brittle. The cause of this difference has long been a subject of speculation to those more immediately interested in the subject, some attributing it to a difference in level of the two localities—a theory, however, which can scarcely be maintained in view of the fact that much of the output from the Black Lake mines, from the higher levels, is of the best quality.

The presence, however, of large masses of the intrusive granulite near Black Lake, as contrasted with its almost entire absence at Thetford, where it is found generally in small dykes, leads to the inference that to this intrusion of heated matter may be largely due the lack of softness and silkiness in much of the Black Lake output. The presence of such great masses would have a tendency to dissipate a certain proportion of the contained water from the chrysotile, which is really a hydrous silicate of magnesia, in the same way as the action of the forest fires, though on a much more extended scale. The same

effect can be produced by placing a piece of the mineral in the fire or on a sufficiently heated surface, when in a short time it will be found to have lost its softness to a large extent and become harsh and brittle.

The extraction of asbestos in the present stage of the industry may rather be termed quarrying than mining proper, the workings so far being all open cuts. The rock is blasted out, broken up, carried to the dumps and subsequently cobbled by hand, the latter being generally done by boys. The smaller veins, of a fourth to a half inch, are frequently left in the rock of the dump, as not in the present state of the industry repaying the cost of extraction. There is no doubt, that with suitable machinery for crushing and cobbling the greater part of most or all of the dumps, which have already reached a large size, would easily pay for working over, while the removal of the dumps themselves, from the fact of their covering much valuable ground, will very shortly become a necessity.

The workings at Thetford are at present confined principally to four companies, viz.: King Bros., The Bell Company, Irving, Johnston & Co., and Ross, Ward & Co. These are all situated on a small knoll of serpentine which rises to a height of 80 to 90 feet above the adjacent track of the Quebec Central Railway which traverses the properties. The output from all these mines is practically the same in quality and length of fibre, though in the quarry of Irving, Johnston & Co., veins of extra width, nearly six and a half inches, have been found. This extra length of fibre does not, however, possess any special advantage, since it is generally broken by grains or partings of iron, and for practical purposes good clear fibre of two to three inches, or even less, is quite as valuable as any. In addition to the properties at this place above mentioned, new workings have lately been commenced by Mr. A. H. Murphy, now of Montreal, and by Lucke & Mitchell, of Sherbrooke, both of which promise well. These are to the west of the railway, and at a lower level, and some extra work may be involved in the removal of a considerable covering of drift in places. The ground between the railway and the Thetford River, which here marks the western limit of the serpentine, has also been lately proved to some extent, and portions of it found to contain asbestos in satisfactory quantity, but the greater facilities for working the upper levels are such as to give them the preference for the present.

At Black Lake, four miles south of Thetford mines, four companies are also located. These are the Anglo-Canadian, the Frechette-Dauville, the Scottish-Canadian and the American Asbestos Company or Wertheim's, at all of which a large amount of work has been done. They are all at higher levels than the mines at Thetford, and the output, as already stated, is not, as a whole, equal in quality comparing the percentage of "firsts" produced. This will be seen from a statement of the relative percentage of the two districts, though this is again to a certain extent affected by the difference in grading practiced by the several companies. Thus from the Thetford area the percentage of "firsts" ranges from 50 to 70; "seconds" from 7 to 30; "thirds" from 20 to 40. From the Black Lake district, the percentages are: "firsts" 10 to 50; "seconds" 25 to 30; "thirds" 20 to 60.

The prices of asbestos are at present quoted at a considerable variation, due to the fact just mentioned that the output from the several mines is to a certain extent differently graded. Thus the "seconds" of one mine are quoted at \$75 per ton, while from another the price of "firsts" is very little more. Extra quality of "firsts" again, naturally commands a higher price than the ordinary run of the grade, but generally speaking it may be said that the scale of prices for the several grades of the output at the mines is as follows: Asbestos, No. 1, \$80 to \$110 per ton of 2,000 pounds; No. 2, \$50 to \$75, and No. 3, \$25 to \$40. In addition to the above a certain amount of waste is obtained from all the mines, and is sold at from \$10 to \$15 per ton.

Taking the scale of prices and the percentage of the higher grades, it is seen that at the present time, commercially speaking, the properties of Thetford are entitled to the first place. This is to some extent explained by the fact that a considerable proportion of the Black Lake output is off-colour, the areas worked lying partly below the crest of the main serpentine ridge, and having a considerable covering of drift. At Thetford, owing to elevation of the knoll on which most of the mines are located, the loose or shattered rock, if it ever existed there, has been largely removed by glacial action, the surface of the rock being frequently polished and striated. It has always been expected that the Black Lake output would increase in value when the shattered surface rock was removed, and this expectation has, to a certain extent, been realized in so far as the workings have proceeded, the rock generally becoming more solid at greater depths, and the color and quality of the fibre improving. New workings along the face of the ridge at this place have also disclosed the presence of large veins of excellent material, and greatly superior to that from the lower works, yielding a large percentage of first quality.

Here the action of the intrusive granulites has not been felt apparently to any considerable extent, and the conditions in this respect more closely resemble those prevailing at Thetford.

In estimating the value of Asbestos properties, the question of the relative percentages of output should be carefully considered, since, while the number of tons produced by two areas might be approximately equal, and to the uninitiated the properties in consequence be nearly equal in value, the one from the large amount of "firsts" would be capable of paying very handsome dividends, while the other would require great economy of management and yield far less satisfactory returns.

In addition to the areas just described, several others are worthy of notice. The knoll of serpentine near Danville, of small extent, has been worked for some years by Mr. Jeffrey, of Richmond, with good results. The veins at this place are not large, seldom reaching two inches in width, but the quality of much of the fibre is excellent, and, though small, a considerable number of them produce a good amount of asbestos. The proportion of "firsts" from this mine is at present about twenty per cent., and of "seconds" 60 per cent., the remainder, of course, being "thirds" thus approximating more closely the output of the mines at Black Lake.

A more curious deposit, however, is that known as the Broughton mine. The asbestos here is apparently confined to a single vein, having a hanging wall, in places, of soapstone. This vein was remarkable for its large size when first worked, being at times nearly or quite a foot thick, as well as for the great silkiness and softness of fibre. It had more the aspect of a well-defined vein, and has been worked for a distance of several hundreds of yards, and to a depth of about 70 feet. In the lower workings, however, it decreased rapidly in size, and at last split up into minute strings, rendering it worthless. Another peculiar feature observed at one of the mines near the Coleraine station is the presence of mica, or a similar mineral, associated with the asbestos veins, or in close proximity to them, and occurring in irregular fissures in the rock, of several inches in width. The rock is much shattered, and the mica is not, in so far as yet observed, found in any of the other mines in this section of the country.

In many places the serpentine is intimately associated with masses of soapstone. In such cases, while occasional small and irregular veins of asbestos may be seen, in none of those examined has the quantity, with the exception of the vein at Broughton, just described, been found to be of much economic importance.

The slate quarries, of which a number have been worked to some extent, occur at various localities throughout the Eastern Townships, and are presumably all confined to the slaty portions of the Cambrian system. Several of these were started in the colored bands of what was formerly styled the Lauzon and Sillery divisions of the Quebec group, where red and green shades are common; others were located in what were regarded as slates of Upper Silurian age, the later investigations in the field having very conclusively shown however that their true position in the geological scale is much lower. At the present time, owing to various causes, the economic extraction of slate is confined to but two places, viz., that of the New Rockland quarry, near Melbourne, and that near Danville. The output of the latter is almost entirely confined to school-slates, while that of the Rockland Company embraces roofing-slates, billiard-table tops, mantels, etc. The character of this slate is reported equal to that of the Welsh quarries.

An interesting feature at the former place, geologically speaking, is the contact of the slates with the serpentine, probably by a line of fault. A ready demand exists for the output from both these quarries, and a large force of men is employed. The New Rockland quarry especially has an excellent plant, with a magnificent water power, transmitted to the works by cable, and an outfit of cable or travelling derricks, which work to perfection. This quarry has at present a depth of 200 feet, and is connected with the line of the Grand Trunk railway, four miles distant, by a narrow-gauge road, by which a great saving in the cost of transportation is effected.

The lime works of the Dudswell Lime and Marble Company are well worthy of notice, both for their very considerable extent and for the great purity of the lime manufactured. They are located on a belt of limestone of Upper Silurian age, which is in places highly fossiliferous, and which rests on the one hand upon Cambrian and pre-Cambrian rocks, and on the other upon the Cambro-Silurian sediments of the great eastern area. In certain portions the limestone has been altered to a highly crystalline and compact marble, which, when polished, presents a very attractive appearance, the corals, of which much of the rock is composed, being well brought out. Other portions of the marble show an intricate banding of dark or blackish shades, alternating with yellowish tints, forming the variety known locally as "black and gold," and which has been very favorably compared with the celebrated Porter marble of Italy. Several thousands of dollars have already been spent in

testing the value of this marble deposit, and the rock, a short distance below the surface, appears quite solid, so that large and compact blocks can be readily obtained. The stone for burning is obtained from large ledges of a dark or grayish rock, in places also crystalline, which in the upper quarry presents a nearly vertical face of 80 to 90 feet. This is in close proximity to the kilns, of which there are 10 in all, 6 in the upper or older works and 4 in the lower and newer works, about a half mile distant. Each of these kilns is stated to have a daily capacity of 300 barrels of lime, so that the entire output is not far from 2,500 to 3,000 barrels daily. The lime manufactured is remarkable for its purity, the foreign matter in the rock averaging not more than 1 to 2 per cent., and has already obtained such a reputation for excellence that it controls the market throughout a large part of Quebec and Ontario, and through the adjoining States as well.

It would scarcely be doing justice to the mineral wealth of the Eastern Townships should we omit all mention of the gold-fields of this district. Discovered first in 1835 by a daughter of one of the *censitaires* of Mr. C. DeLery, in a small stream called the Touffe des Pins, a branch of the Chaudière River, that gentleman, on being made aware of the fact, easily confirmed it by examination of the locality, and obtained several pieces of considerable value. Subsequent explorations of this stream and its tributaries showed that the gold was scattered over a very considerable area, being, in fact, obtainable in greater or less quantity in nearly all the branches of the Chaudière, as well as in the bed of that stream where it was accessible, nearly from the boundary of Maine to that of the seignior of St. Marie.

The limits of this gold-field were gradually extended, and it was found on examination, both on the part of the Geological Survey and by private individuals, that the metal could be obtained, by simple washing in the pan, from the sands and gravels of nearly every stream south from the Chaudière to New Hampshire and Vermont. The character of much of the gold over this area was so fine that the returns were not found to repay the labor of hand-washing, but in certain portions, notably in the upper Chaudière and its branches, and in the south-eastern portion of the province, in the township of Ditton, much coarse gold existed, from which nuggets of large size were obtained, reaching a value in some cases of over \$1,000. The greater part of this coarse gold was water worn, but occasional large pieces were found which were comparatively ragged and had quartz attached.

For some years the source from which this gold was derived was a question not clearly understood. It was first regarded as belonging to the quartz-veins which occurred in the crystalline schists of the Notre Dame range of hills, which traverse a considerable portion of the country in a northeasterly direction, the materials from their disintegration being spread over a considerable area to the south. The age of the rock underlying the area in which the gold was most commonly found was, at that time, regarded as Upper Silurian.

On the upper branches of the Chaudière, and on the Du Loup stream, heavy beds of gravel occur which were deemed worthy of a careful test as to their value as a source of gold; and a series of washings, made in 1851-52, under very disadvantageous circumstances, however, and with very ordinary appliances, showed a very fair margin of profit to operations if conducted in the large way and with a proper expenditure of capital, many of the large areas of gravel being found sufficiently rich to warrant such an enterprise. Unfortunately, the only attempts of any considerable importance in this direction, either through lack of proper management or other causes, do not appear to have been so successful as anticipated; an experience, however, that should not be held as conclusively establishing the unprofitableness of the entire section.

The Ditton area, being entirely in private hands, has furnished no official returns from which the quantity of gold obtained from this district can be ascertained; though, from the coarse character of the gold there found, and the fact that certain persons have carried on mining continuously for many years, it is evident that much rich ground exists on the upper branches of the Salmon River. The appliances for mining and saving the gold appeared to be of the crudest kind, no provision existing for the extraction of the finer portion of the yield. Nuggets of \$50 to \$150 are reported from this place, and many quartz-veins traverse the black slates and sandstones which form the country rocks. Some of these are, without doubt, auriferous, from the fact that ragged gold in quartz is found in close proximity to them.

The largest operations in gold mining have been carried on in the Beauce section, and principally on a branch of the Chaudière River, known as the River Gilbert. Here, also, the mining was of a very crude kind; but though the returns for this area are largely incomplete, the official figures show that for 1877 to 1883 a very considerable quantity of gold was obtained, even under the very unfavorable conditions that prevailed. Much of the gold was very coarse, large nuggets being frequent. Owing to litigation and other causes, the mining on this

stream has, to a large extent, been abandoned, though a large part of the old river channel, from which the greater part of the gold was obtained, yet remains untouched.

The presence of these old river channels in the tributaries of the Chaudière River is a very important feature in connection with the profitable extraction of gold in this locality. Indications of these are visible on the Famine River, the Pozer stream, the Gilbert, which has been worked to some extent and already referred to, the Des Plantes and the Millstream, where successful mining is being carried on at the present time. The bottoms of these channels, which are, in places, many feet below the present water courses, of the streams, contain several feet of well-defined river gravel cemented with sand and clay, in which the greater part of the coarse gold occurs, the upper portion being largely occupied with quicksands, gravel and clay. On the Millstream, also, there appears to be a great lack of appliances for saving the fine gold, the greater part of which is undoubtedly carried down the sluices and lost in the main stream.

A series of essays and examinations, conducted by Messrs. Hunt and Michel, and published in the *Geological Survey Report*, 1866, shows conclusively that many of the quartz-veins in the Chaudière district contain gold in paying quantity. The greater ease of working the gravels, however, and the present lack of capital, has, as yet, diverted attention from the working of these quartz-leads. This lack of capital is, to some extent, due doubtless to certain peculiar conditions of tenure of the lands which are not considered satisfactory to those contemplating investment in this direction. If these were put on a proper basis, and the country thrown open as a mining district, good results would certainly follow.

It will, however, probably be found that the most profitable fields of investment will be confined to the areas of Cambrian slates, and, judging from the fact that the largest nuggets have been obtained in close proximity to certain well-defined quartz-veins which occur in the vicinity of lines of anticlinal structure, the principle now generally admitted in the Nova Scotia gold-fields, that the paying leads are located near these anticlinal axes, will doubtless be found to apply to the gold-fields of eastern Quebec.

In this connection it may be mentioned that in their character the slates and hard sandstones of the Quebec gold-fields are very similar to those of Nova Scotia, and they in all probability belong to the same geological horizon. The southward extension of the Ditton gold field should be looked for and found in that portion of New Hampshire adjoining and lying on the upper waters of the Connecticut River between the Hall and Indian streams. Since black slate and schistose sandstones have been reported by Prof. Hitchcock as there existing, precisely similar in lithological character to those of the Ditton area, and since the strike of the beds in both places is continuous, the valleys of the streams in that section should be also auriferous.

Of argentiferous galena, rich veins are known to exist, more especially in the Cambrian rocks of the Chaudière River, and upon the Du Loup, one of its principal branches from the east. Assays from some of these veins show a percentage of silver ranging from \$30 to over \$400 per ton. The veins are of good size, but the largest deposit, that of Risborough and Marlow, is at present accessible with difficulty. This will be shortly overcome by the proposed extension of the Quebec Central Railway, which is to cross this area, then these properties should become very valuable.

Of the iron ores it need only be said that deposits occur at various points, some of which are of great purity and excellence. The great drawback, at present, to their successful working is the lack of suitable fuel for smelting, wood for charcoal being generally too scarce in the immediate vicinity, while the geological formations in Quebec and Ontario are such as to render the chances of finding coal in either province an impossibility. Should the problem of cheap transportation of coal, either from the mines of Nova Scotia or from those of the United States, to some central point, such as Montreal or Sherbrooke, ever be solved, it is confidently anticipated that these ores will form no inconsiderable factor in the mineral wealth of eastern Quebec.

The deposit of antimony near Garthby has been known for many years, and beautiful specimens can be obtained there, but the lack of a market, in view of the occurrence of large veins of the mineral in Nova Scotia and New Brunswick, and the lack of facilities for extraction on the spot, have hitherto interfered with its successful development. This, also, is one of the problems that should be solved in the near future.

It will be seen from this sketch of some of the leading minerals in this portion of the Dominion, that the chances for the profitable investment of capital in several important lines are not few. Improved methods of mining, a more extended market, and, in the case of the gold, greater security of title to those desiring to invest with a view to scientific mining operations will do much to improve them. The great value of these several industries is only now beginning to be understood, and it

can be safely predicted that before many years the mining industries of this section will take a much more prominent position than they have ever yet enjoyed, and will be regarded with increasing favor as a field for profitable investment by capitalists both at home and abroad.

The Geological Relations of the Principal Nova Scotia Minerals.*

BY E. GILPIN, JR., HALIFAX, N.S.

Any estimate of the economic mineral value of an unvisited district is to the mining engineer largely a comparative one. If he knows that certain minerals characterize any given geological horizon he naturally draws upon his experience of the same ores as met by him under similar geological conditions. And if he has not had the personal experience, the investigation of the geology of a similar district as given in a trustworthy report enables him to lay a fair basis for conclusions.

In a general way these conclusions are of value, and while they pronounce on the possible mineral fecundity of a given district, they often give a decided rebuttal to startling statements of discoveries of ores.

The number of the geological horizons in Nova Scotia is limited, but they are well developed, in some cases typically, and exert a prominent effect on the agricultural and industrial distribution of its inhabitants.

The following table, based on Sir William Dawson's *Acadian Geology*, will serve as an outline for my notes:

Modern.

Triassic sandstone and trap.

Permo Carboniferous.

Carboniferous { Upper coal measures.
Productive coal measures.
Millstone grit.
Marine limestone.

Devonian { Lower Carboniferous.
Upper Helderberg.

Upper Silurian { Oriskany.
Lower Helderberg.

Clinton.

Lower Silurian.

Cambro-Silurian.

Cambrian, Longmynd series.

Laurentian.

This list is intended to refer rather to the divisions known to contain ores, than to be a complete geological scale of the province.

Geographically speaking, in Nova Scotia proper these divisions are represented as follows: On the Atlantic coast are the Cambrian of the gold-fields with their associated granites. Then follow the measures of the Cobequids running through Cumberland, Pictou, Colchester and Antigonish counties, supporting Silurian and Devonian strata, the latter being met also in the western part of the province. The Carboniferous occupies the gulf shore, and much of the district surrounding the basin of Minas. The Triassic measures are met in narrow fringes and outliers around the Bay of Fundy. In Cape Breton the northern part of the island is largely composed of Laurentian, which occurs also between the arms of the Bras d'Or Lake. The Carboniferous rests on it, and forms fringes, while it is replaced in Richmond county by several large areas of Devonian.

Taking the divisions in descending order, their best known minerals are:

Modern.—Beds of bog iron-ore, manganese wad, peat, infusorial earth and clays are frequently met. A number of years ago the iron ore was smelted in connection with older ores, at Clementsport near Annapolis. Deposits of considerable extent have been observed in Shelburne, Queens, Kings, and Pictou counties, and no doubt exist at many other localities. The wads are met in Cape Breton at several points, in deposits of considerable size, yielding from 20 to 40 per cent. of ore with water, iron, silicious matter, etc. Smaller deposits are not unfrequently found, but as there is no demand they are not sought after. The deposits of infusorial earth have been used locally for insulating steam pipes, and as an absorbent in the manufacture of dynamite.

Triassic.—The trap and associated ash-beds yield numerous varieties of zeolitic and other minerals. At several points they are penetrated by veins of massive and crystalline magnetite and specular ore of remarkable purity. The thickest vein that has come under the writer's notice, of magnetite, was about 15 inches wide.

At numerous points, most noticeable at Margareville, copper ores, principally carbonates with native copper, are found in veins in the trap and ash. These veins have been explored several times without success. No records have been made of the "low-grade" values of these rocks, and I believe from the frequent occurrence of copper ores over so wide an extent of territory that locally, beds may be found carrying the disseminated metal in amounts of economic value. The associated sandstones,

*Read at Ottawa meeting Am. Inst. M.E.

red and friable, yield no building stone of value, and as yet have furnished to the miner only a few tons of manganeseiferous ochre.

Permo-Carboniferous.—In the great mass of sediments covering large areas in Pictou, Colchester, and Cumberland counties, and presenting fossil evidence of a transition from the Carboniferous to the Permian, there are few minerals of economic value. A few thin seams of coal are met, with fire-clay. At numerous points the sandstones and shales present irregular bedded masses and layers of copper ores, principally gray sulphurets, with films and coatings of carbonate. These ores are associated with fossil plants to whose presence their deposition is to be attributed. Hitherto, attempts to find these ores in workable amounts have not been successful. A sample from Caribou, near Pictou, gave:*

	Per cent.
Copper.....	40.00
Iron.....	11.06
Cobalt.....	2.10
Manganese.....	0.50
Sulphur.....	25.42
Lime.....	0.92

Admirable varieties of building stone, variously tinted sandstones and free-stones have been quarried from these measures.

Upper Coal Measures.—These strata in general resemble those noticed in the preceding section. There is however more coal; and layers of clay iron-stone are frequently met.

Productive or Middle Coal Measures.—The principal mineral of this formation is coal, which is worked in Cape Breton, Pictou and Cumberland counties. Deposits are known in five other counties, but have not been worked to any extent. The production last year was about 1,700,000 tons. The coal is bituminous, and the writer is not aware of the occurrence of any hard coal, although several discoveries of graphitic shale have been heralded as anthracite mines. Speaking in general terms the Cape Breton coal is the most bituminous, that of Cumberland less so, while the Pictou coals rather approach the semi-bituminous or steam variety. All the districts furnish coke of fair quality.

The following average of an analyses, from a paper on Canadian coals, read before the Montreal meeting of the British Association, will serve to show the variation in quality:

	Cape Breton.	Pictou.	Cumberland.
Moisture.....	0.75	1.19	1.46
Vol. combustible matter.....	37.26	29.10	33.69
Fixed carbon....	58.74	60.63	59.35
Ash.....	3.25	9.34	5.50

The fire-clays accompanying these coals have never been systematically tested as to their value for fire-brick. Some that have come under my notice are too high in alkali and iron, while others theoretically were of satisfactory composition. An investigation into the capabilities of the fire-clays of Nova Scotia would form an object worthy the attention of the Canadian Geological Survey. Beds of cannel and oil coal, and of bituminous shale, are frequently met, but are not at present of economic value.

Beds of clay iron-stone (in a few instances of the black band variety) up to a thickness of 12 inches are numerous. The following analyses made by me are samples from the Pictou coal field:

	Clay Iron-stone.	Black Band.
Moisture.....	2.132	0.732
Iron protoxide....	45.361	36.000
Alumina.....	16.962	3.180
Silicious residue...	0.780	16.546
Lime.....	trace	3.780
Magnesia.....	1.655	0.783
Manganese.....	trace	4.450
Sulphur.....	0.612	0.214
Phosphoric acid....	trace	.586
Carbonaceous matter	.....	6.140
Carbonic acid.....	.....	27.589
Metallic iron.....	35.00	28.000

Millstone Grit.—The dividing line "between the millstone grit and productive measures is not a fixed one, and consequently there are workable beds of coal in its upper part referred to this horizon, but practically belonging to the productive measures. Throughout this range of measures thin seams of coal occur at numerous points, but in the presence of the larger and better known beds they have not yet received attention. At the Joggins, Cumberland county, large quantities of excellent grindstones are made for local use, and for export, and numerous beds of quarry rock are known.

Marine Limestone.—This horizon is very strongly developed in Nova Scotia, and to its presence is due the fertility of the central and northern part of the province, for its gypsum, limestone, and marl yield soils of permanent fertility. Its most prominent mineral is gypsum, in every variety and texture, which occurs in beds in many cases extending for miles, and reaching in thick-

ness 100 feet. It is quarried for export to the United States, chiefly near Windsor, in the basin of Minas, the annual production varying from 100,000 to 150,000 tons. A few thousand tons are annually sent up the Gulf of St. Lawrence from Cape Breton, but the export trade, on account of the difference in freight, is from the Windsor district. Limestone is equally abundant, and is burned for local use, and used in rough masonry, and at Walton, near Windsor, furnishes a beautiful red stone, which it is said will first be used in the new buildings of a prominent New York newspaper. At several points these limestones carry deposits of manganese, lead, iron, and copper ores and barytes. The manganese is met as pyrolusite with a little hard ore, and is of remarkable purity, carrying very minute amounts of iron. It brings a price varying up to \$100 a ton, but the demand is limited. I am not aware of any deposits of these ores adapted to the steel-makers' purposes. Tenny Cape, Onslow, and Loch Lomond are the best known mines.

The iron ores are limonite, red hematite, and spathic ore. As yet the ores of this series are little worked, but they are of undoubted value. The purity of some of them may be shown by the following analysis of a sample from Brookfield:

	Per cent.
Water.....	11.36
Silica.....	1.54
Sulphuric acid.....	trace
Phosphoric acid.....	trace
Metallic iron.....	60.00

The spathic ore occurs in beds, the limonite and red hematites as contact and replacement deposits. The lead-ores occur as small segregated veins, and as aggregates. The silver contents of the Nova Scotia lead-ores are variable, assays have returned as high as 100 ounces, but the average would not exceed 10 ounces. The copper-ores resemble in composition and mode of occurrence those already described. Celestine, fluorspar, and brine and mineral springs also occur in these measures.

Devonian (Upper Helderberg, Oriskany).—In the hills lying to the south of the Annapolis valley are numerous important bedded deposits of magnetite and hematite. The ores vary in character, but some are of excellent quality and favourably situated for mining and exportation. In Guysboro' county the Devonian measures carry several large deposits of specular ore of good quality, but as yet unproven. The ore is presented in veins and in large masses, and may be connected with the dioritic dykes found at this point. It occurs under similar conditions near St. Peters. I believe that by some the copper-ores of Pilsbory Lake and Lochaber in Antigonish County are referred to this horizon. These deposits are connected with igneous dykes, and, as far as they have been explored, appear very promising, but their distance from shipping, etc., has diverted attention from them.

Upper Silurian.—(Lower Helderberg, Clinton).—In Pictou and Antigonish counties, strata which are referred to this age carry important deposits of bedded red hematites, varying in thickness up to 50 feet. The ores are silicious, but frequently free from sulphur and phosphorus; their metallic contents vary from 35 to 50 per cent. Owing to their size and accessibility they can be cheaply mined, and will probably be utilized in connection with the richer ores found in their vicinity.

Lower Silurian.—These measures, as developed in Cape Breton carry several beds of red hematite, and deposits of copper pyrites and sometimes cupriferous iron pyrites.

Cambro-Silurian.—This term has been provisionally applied to the mass of strata forming the Cobequid hills and reappearing in Pictou County. The ores occurring in these measures embrace several varieties of hydrated and anhydrous peroxide. At Londonderry the limonite occurs with a little specular in a large interstratified vein containing ankerite and sideropelites, the latter being used to some extent in the furnaces of the company operating at this point. Magnetites have also been met in parts of this range. In Pictou County the ores occur in interstratified veins in the ankerite, but are principally specular. Copper and gold ores are reported as occurring in this range, but I am uninformed concerning their economic value. The deposits of antimony-ore, at Rawdon, Hants County, have been worked for several years, and are probably extensive. Their exact geological horizon is not yet clearly known, but they are referred to here.

Cambrian (Longmynd).—The only mineral of economic value yet found in these measures is gold. The strata are slate and quartzite lying in large abrupt folds, which have permitted the intercalation of the gold-bearing quartz-veins, varying in thickness up to 12 feet. The gold is also found disseminated in some of the beds of slate. Copper, lead, zinc, iron, and molybdenum sulphides occur with the gold in the quartz-veins, but not in amounts of economic value. The auriferous territory is estimated to cover 3,000 square miles, and as the annual production of gold is only about 23,000 ounces, there is ample opening for miners.

Laurentian.—This series is widely distributed in Cape Breton, and roughly speaking is divisible into the felsite and the limestone series. They contain red hematite, in places magnetic, of excellent quality, although some are reported to be rather high in phosphorus for Bessemer purposes. Copper ores, graphite, asbestos and mica are also found. The limestones are frequently altered into marbles. Some of the deposits are beautifully tinted, and are said to be adapted for building and statuary purposes. At present the West Bay (Cape Breton) marble is largely burned into a lime of excellent quality, which is used in the province, and exported to the United States, etc. To complete the parallel between these Cape Breton strata and the Laurentian rocks of the vicinity of Ottawa, there remains to be discovered in the former "Phosphate Rock," and there appears to be no reason for its absence.

Copper ores are found at numerous points and are undoubtedly valuable as they are widespread and at the surface show well, but up to this date no decided steps for development have been made except in the case of the copper ores of Coxheath, near Sydney. Here the Eastern Development Company has proved several large veins carrying copper in workable amounts to a depth of 300 feet. The ore is calcopryrite with erubescite, and carries considerable amounts of gold and silver. Molybdenite also occurs in small disseminated grains and nodules at several points, and a few lots have been shipped to England.

In summing up these brief notes it may be said that the visitor to the province would place the minerals, irrespective of any development effected, in the following order: Coal, Iron, Gold. It is perhaps unusual to find these three so close together.

Parties desiring extra copies of this issue should write at once for them as no spare copies can be furnished within ten days succeeding publication.

Gold Mining Supplies.

The principal depot in Nova Scotia, carrying the most complete assortment of first class goods, is

H. H. FULLER & CO'S,

41 to 45 Upper Water St., Halifax, N.S.

Our line comprises Explosives, Fuse, American and English Mill and Hammer Steel, Bar and Bolt Iron, Steel Wire Hoisting Rope, Hemp and Manilla Rope, Rubber and Leather Belting, Miners' Candles, Oils and Lamps, Miners' Tools, Machinists' Tools, Blacksmiths' Tools, and every requisite for the gold miner.

H. H. FULLER & CO.,

Halifax, N.S.



North-West Mounted Police.

RECRUITS.

APPlicants must be between the ages of Twenty-two and Forty, active, able-bodied men of thoroughly sound constitution, and must produce certificates of exemplary character and sobriety.

They must understand the care and management of horses, and be able to ride well.

The minimum height is 5 feet 8 inches, the minimum chest measurement 35 inches, and the maximum weight 175 pounds.

The term of engagement is five years.

The rates of pay are as follows:—
Staff-Sergeants.....\$1.00 to \$1.50 per day
Other Non-Com. Officers.....85c. to 1.00 " " "

	Service pay.	Good conduct pay.	Total.
1st year's service, soc.	—	—	50c. per day.
2nd " " " "	50	50c.	55 " "
3rd " " " "	50	10	60 " "
4th " " " "	50	15	65 " "
5th " " " "	50	20	70 " "

Extra pay is allowed to a limited number of blacksmiths, carpenters and other artisans.

Members of the force are supplied with free rations, a free kit on joining and periodical issues during the term of service.

Applicants may be engaged at the Immigration office, Winnipeg, Manitoba; or at the Headquarters of the Force, Regina, N.W.T.

ALFRED SMITH, M.E., Etc. Etc.

IS OPEN TO ACT AS

Consulting Engineer to Gold Mining Companies.

Examinations and Reports on Mines carefully made out and prepared. The treatment of refractory ores a specialty. Estimates made for the erection of the most approved machinery for treating. First class references in England, Nova Scotia and the U.S.A.

ADDRESS:
ALFRED SMITH, - - - Sheet Harbor, N.S.
Cable Address.—Tapsmith, Sheet Harbor.

PHOSPHATE LANDS FOR SALE

600 ACRES

IN THE

BOBB'S LAKE DISTRICT, ONT.

These lands are on the Surveyed extension of the proposed Brockville, Westport and Sault Ste. Marie Railway, and are located within four miles from Station on the Toronto and Ottawa Division of the C. P. Ry.

Splendid show for developments made. Highest grade of ore. Half interest for sale; or owner will convey an interest for cost of slight further developments.

Further particulars by addressing,

P.O. Box 126,

SAULT STE. MARIE, ONT.



SEALED TENDERS marked "For Mounted Police Clothing Supplies," and addressed to the Honourable the Minister of Railways and Canals, will be received up to noon on Wednesday, 26th February, 1890.

Printed forms of tender containing full information as to the articles and quantities required, may be had on application to the undersigned.

No tender will be received unless made on such printed form. Patterns of articles may be seen at Each tender must be accompanied by an accepted Canadian bank cheque for an amount equal to ten per cent. of the total value of the articles tendered for, which will be forfeited if the party decline to enter into contract when called upon to do so, or if he fail to supply the articles contracted for. If the tender be not accepted the cheque will be returned.

No payment will be made to any newspapers inserting this advertisement without authority having been first obtained.

FRED. WHITE,
Comptroller N.W.M. Police.
Ottawa, January 24th, 1890.

LEDOUX & COMPANY,

10 CEDAR ST., NEW YORK,

Engineers, Metallurgists & Assayers.

Public Ore Sampling & Storage Works

All the principal buyers of furnace materials in the world purchase and pay cash against our certificates of assay, through New York banks.

By special permission of the Secretary of the Treasury of the United States, cars of ore or copper matte passing through in bond can be opened and sampled at our works.

Consignments received and sold to highest bidder. Send for circular giving full particulars.

Mines examined and sampled. Assays and Analyses of all kinds.

THE BELL TELEPHONE CO. OF CANADA.

ANDREW ROBERTSON, PRESIDENT

C. F. SISE, VICE-PRESIDENT

C. P. SCLATER, SECRETARY-TREASURER

HEAD OFFICE, - MONTREAL.

H. C. BAKER, Manager Ontario Department, HAMILTON.

This Company will sell its instruments at prices ranging from \$10 to \$25 per set. These instruments are under the protection of the Company's patents, and purchasers are therefore entirely free from risk of litigation.

This Company will arrange to connect places not having telegraphic facilities with the nearest telegraph office, or it will build private lines for firms or individuals, connecting their places of business or residences. It is also prepared to manufacture all kinds of electrical apparatus.

Full particulars can be obtained at the Company's offices as above, or at St. John, N.B., Halifax, N.S., Winnipeg, Man., Victoria, B.C.

Standard Powder Company

MANUFACTURERS OF ALL KINDS OF

GLYCERINE

EXPLOSIVES

—FOR—

MINING

—AND—

RAILROAD WORK.

ADDRESS—

W. H. HARRISON,

MANAGER,

BROCKVILLE, ONT.

CANADA ATLANTIC RAILWAY.

THE SHORTEST PASSENGER ROUTE BETWEEN

Ottawa & Montreal

AND ALL POINTS EAST & SOUTH.

The only road in Canada running trains lighted with electricity and heated by steam from the engine. Luxurious Buffet Pullman Palace Cars on all trains between Ottawa and Montreal. Only line running through Sleeping Cars between

OTTAWA, BOSTON AND NEW YORK

And all New England and New York points.

Baggage checked to all points and passed by Customs in transit.

For Tickets, Time Tables and information apply to nearest agent,

or to S. EBBS, City Passenger Agent,

GEO. H. PHILLIPS, Gen. Agent, 24 Sparks St., OTTAWA.

VALLEYFIELD.

A. E. CAIRNS, General Agent,

136 St. James St., MONTREAL.

Or at 260 Washington St., Boston, and

317 Broadway, New York.

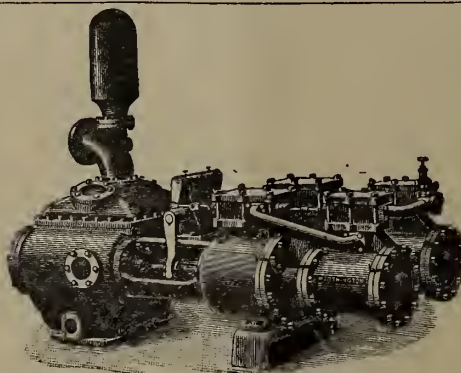
E. J. CHAMBERLAIN,

General Manager,

General Offices, Ottawa.

C. J. SMITH,

General Passenger Agent



Canadian Agents for

WORTHINGTON DUPLEX

Steam Pumps,

—FOR—

MINES, QUARRIES AND OTHER PURPOSES

Machinery of all kinds.

R. H. BUCHANAN & Co., 64 Craig St.,

Builders of Water Works.

MONTREAL.

Send for Circular.

ALL KINDS OF RUBBER GOODS for MINING PURPOSES

MANUFACTURED BY

THE CUTTA PERCHA AND RUBBER MFG. CO. OF TORONTO,

43 YONGE STREET, TORONTO.

Steam & Air Hose, Rubber Bumpers and Springs, Fire Hose, Pulley Covering, Rubber Clothing & Boots.

The Canadian Mining Review

CONDUCTED BY B. T. A. BELL

OFFICES:

UNION CHAMBERS, 14 METCALFE ST.,
OTTAWA.

THE OFFICIAL ORGAN

Of the Gold Miners' Association of Nova
Scotia, the Canadian Phosphate, Asbes-
tos, Coal, Silver and other Mining
Interests.

PUBLISHED ON THE 25th OF EACH MONTH.

SUBSCRIPTION RATES.

ONE YEAR (in advance) \$1.50
SIX MONTHS..... 1.00
SINGLE COPY15
BRITISH AND EUROPEAN (post paid)..... 1.75

ADVERTISING RATES.

SPACE.	ONE MONTH.	THREE MONTHS.	SIX MONTHS.	TWELVE MONTHS.
One Page.....	\$30.00	\$70.00	\$130.00	\$250.00
One-Half Page...	20.00	40.00	70.00	130.00
One-quarter Page..	10.00	25.00	40.00	75.00
One-Eighth Page..	8.00	15.00	25.00	40.00

Professional and Business Cards.

Advertisements under this head inserted at the rate of \$15.00
per year per inch.

Want Column.

Fifteen cents per line; no advertisement to occupy less than two
lines. Orders for this column, and for all transient advertisements,
must be accompanied by cash.

Remittances.

Remittances should always be made by Bank Drafts, Cheques or
Post Office Orders, made payable to the Manager. American
Postage Stamps are of no use to us whatever, and will not be
accepted in payment of small amounts.

Co-Operation Invited.

The publishers earnestly request the co-operation of readers of
the REVIEW for information, communications that can be utilized,
suggestions, news items, etc., etc. All such should be addressed
to the Editor.

Vol. IX. MARCH, 1890. No. 3.

The Duty of Mining Machinery.

In another place our readers will find a full
report of the recent debate in the House of
Commons upon the question of a remission of
of the present tariff upon imports of mining
machinery. A measure which will ensure the
admission free of duty of all mining machinery
not manufactured in the Dominion, and which,
at the same time, will grant a reasonable pro-
tection to those manufacturing interests already
established in our midst is eminently desirable,
and will do much to further and promote the
development of our mines. The subject will be
discussed again when the Budget is before the
House; and from all we can learn there is
every indication that a measure, such as we
have indicated, will be adopted.

Some Proposed Changes in the Ontario Mining Laws.

The General Mining Act of Ontario, 1877,
has long been a legitimate subject for criticism,
having some few good points, some bad ones,
but the most very indifferent. It is a matter of
notoriety that under the provisions of this Act
large areas of valuable mining lands have been
sold and are now lying idle, no provision re-

garding their mineral development having been
coupled with the patent given by the Govern-
ment. It has therefore been with considerable
curiosity and some hope that we have examined
the two Bills which have been brought forward
in the Ontario Legislature this winter, amending
or supplementing the General Mining Act.

We may confess to a little disappointment in
finding that these Bills cover only two of the
many sections or divisions of the Act requiring
revision, and that the defect alluded to above
has not been included. One of these Bills is
entitled "The Mining Claims Act of 1890,"
and deals only with that portion of the public
lands which has not been sold, *i.e.*, vacant
Crown lands. To some minor points of this
Bill (to which detailed reference is made later)
exceptions may honestly be taken, but the bill
as a whole is good, its recommendations are
many, and it is a decided step forward and in
the right direction. The mode of procedure to
be followed by a discoverer in order to obtain a
mining claim is set forth in a plain, direct and
explicit manner, devoid of any technicality not
easily understood by the average prospector.
In examining this Bill the following points have
occurred to us, and we give publicity to them,
not in any spirit of adverse criticism, but wish-
ing to help on, if possible, a good work already
begun:

To section 5 a provision might be added re-
quiring that a duplicate of the rough sketch
accompanying the application should be posted
on a board set in a conspicuous place on the
claim pending the survey of such claim by a
P. L. S., and that when so surveyed a copy of
the surveyor's plot and field notes be so posted
until a patent for the same has been issued and
accepted. This is not an absolutely necessary
feature, but we think it strongly advisable that
every possible step should be taken at the be-
ginning to prevent the possible clouding of a
title, and to prevent or lessen the chances of
the same ground or a portion thereof being
staked out by a junior claimant; thereby avoid-
ing the risks of conflict and subsequent liti-
gation.

In section 6 some reference might be made
as to the provincial land surveyor tying his sur-
vey to some natural or permanent monument
when in unsurveyed lands. Perhaps a reference
to the meridian would be better, but would in-
volve the surveyor's using solar attachment for
their instruments. Any measure looking to the
fixing of what have been called "floating
claims" is most desirable, and will be welcomed
in the mining districts.

It is hard for us to see the force of the ob-
jection contained in these words in section 7:
"But the said lands or any part thereof shall not
be re-staked by or on behalf of or for the benefit,
directly or indirectly, of the claimant, or anyone
claiming or holding through him or them." Why
a claim thus forfeited or abandoned, and by

that very action reverted back to the domain
and possession of the Crown, should not be
open to be again staked by anyone whatsoever,
even by the delinquent claimant himself, we fail
to see. It seems on its face to be a harsh and
inequitable provision, and we feel sure it can
and will be easily evaded. Circumstances are
numerous in almost every prospector's life,
whereby a claimant might be unfortunate
enough to be unable to comply, within the spec-
ified time, with the requirements of the Act. It
seems to us better to allow such an one an even
chance with others.

Possibly, also, there is room for debate as to
the wisdom (sec. 8) of any legislation curtailing
the aggregation of mining property into suffi-
ciently large blocks to warrant and induce the
investment of capital. We are aware that this
section applies only to "mining claims," and
not to lands obtained by "purchase or other
wise," but the reasoning may be as valid for the
one as the other.

The Bill, however, as we have said before, is
good and should pass, and we hope sincerely
that other Bills, looking to the remedy of other
deficiencies and inaccuracies, will be introduced.
There are still many sections of the General
Mining Act which are defective; for instance,
we hope to see the qualifications of the Inspec-
tor put upon a higher footing; such officers
should be competent, educated and trained
mining engineers, as well as petty justices of the
peace. A provision also is needed granting (as
in the United States and Nova Scotia) a right
of way over any and all mining claims or loca-
tions, for roads, ditches, canals, tunnels, etc.,
when required for the working of other mining
properties, providing at the same time proper
safeguards for the damages occasioned thereby.

Another Bill which has been introduced is
called "An Act to regulate mining operations."

This Bill is simply a necessary piece of regu-
lating legislation; it is modelled (in places *ver-
batim*) upon the "Mines Regulation Chapter"
of the Nova Scotia Statutes, but is neither so
full nor so effective as the latter. There is need
of such an Act, and but little criticism can be
made upon its provisions.

Section 11, however, requiring that notice be
sent to the Inspector every time a new shaft is
commenced, or the working of an old one is dis-
continued for two months, is entirely unneces-
sary, excepting in coal mines, and in the Nova
Scotia Statutes these provisions are expressly
confined to coal mines.

We also think Section 13 too weak; no law
can be framed too strongly which prohibits abso-
lutely the holding, by an Inspector, of any
interest whatever, however slight or small, direct
or indirect, in any mine situated in any district
under his jurisdiction; and the penalties cannot
be too large or heavy.

We note, also, the omission from this Chapter
of any provision for a second or escapement
shaft. This is an important omission, and should
be remedied.

Iron Ship Building in Nova Scotia.

The Province of Nova Scotia presents an almost continuous line of sea shore, and even the narrow isthmus of Chignecto connecting it with the mainland will soon be crossed by a marine or ship railway, so that it would then be fairly termed an island, as a vessel can make a circuit around it. Its shores do not present long unbroken ranges of inhospitable cliffs, but harbor succeeds harbor, and these open on sheltered bays. This convenience of shelter, and the proximity of large tracts of timber forests, gave rise to a large lumber business. The absence of roads and the accommodating ocean highway at every man's door, invoked a vigorous coasting trade. It is, therefore not to be wondered at that the Nova Scotians, with their natural mechanical ability turned readily to wooden shipbuilding, big ships to carry lumber, and equally big ships to sell to foreigners, smaller ships to carry fish, etc. to the West Indies, and coasters to carry coals to the United States, and to collect fish from every cove of Labrador and Newfoundland for the distributing centres, and a great fleet of schooners and brave little boats for fishing in the rough surges of the shore banks.

Thus grew the graceful procession of vessels, and daily there slid from the sloping ways, the trim schooner, and the stately barque full rigged, and waiting only her cargo to set sail. This went on until some careful compiler of statistics found out that every man, woman and child in the Province owned enough tonnage of shipping to give each a vessel of their own. Finally some hard headed man conceived the idea of making steam compete with sails, and of pitting iron against wood. The barques built in the sunny creeks of the Bay of Fundy from the pleasant grooves of the uplands were confronted by the products of the gloomy iron and coal mines of Glasgow and the Tyne.

Thin of skin, carrying great cargoes, paying few men, disdainful of breezes, the ocean tramps soon secured the shipper's favor. Until at last the sailing vessel close pressed, finds occupation in charters where time and cargo combine to equalise the price of a ton of coal. The coaster finds her freight gone when a sturdy steamer runs from port to port with the regularity of a railway train, and a few tons of coal neutralise a breeze which meant hours of watching for the best built fore-and-after.

This applied to the province means that broadly speaking Othello's occupation is gone, for now when the cordage, iron, canvas, provisions, etc., can be provided at home, the coal shipping harbors and the mercantile ports, instead of the crowds of square rigged vessels of a decade passed, show only a few rusty steamers. These boats, carrying some 2,000 tons, load rapidly, steam away and return to the coal shoots in a few days from Montreal and Quebec. Long and narrow, numerous hatches receive the coal, and a half score of rattling steam winches rapidly discharge the cargo on the wharves. The steamers monopolise the trade of the Gulf. Some return

empty to the harbors of Pictou and Sydney, while others readily carry at nominal rates, return cargoes of flour, etc., and in the fall they disappear to engage in the general carrying trade of the world.

The force of the inevitable has been conceded; a steamer is now purchased by the local capitalist, who used to build a schooner in his back yard. The question is "could not the steamer be built here by the sons as profitably as the barque or schooner was by their fathers?" To realise the problem it is necessary to notice the conditions under which the shipbuilding trade has grown abroad. In the chief English ship yards are great stores of iron and steel, and the closer the ship yard is to the iron ore and the coal mine, the cheaper the steamer can be built.

In Canada these favorable conditions exist in Nova Scotia, and Pictou and Sydney can be pointed out as localities well adapted for building iron vessels. At Pictou Harbor immense deposits of iron, coal and limestone lie within a radius of a few miles, in a district traversed by railways, and well cleared and settled. Much has been said of the cheap pig irons of Alabama and Tennessee, but American iron masters have repeatedly predicted that it can be made much cheaper by many a per cent. at this point. The ores are of almost all varieties, adapted for steel, as well as for the cheaper grades used for many industries. At Sydney Harbor the distance between the three requisites is greater, but water and railway communications are favourable enough to neutralise this. Both these points can draw upon the large deposits of iron ore known to exist in Labrador, Newfoundland and Quebec. In brief, it may be said that at no point on the seaboard of the American continent, except perhaps in British Columbia, are the conditions for this business as favourable as in Nova Scotia. The Province resembles Great Britain in this respect, and the eye of the doubter fails to see why the new Scotia may not worthily rival the ship yards of the Clyde.

Conceding the fact that every advantage is offered here for making cheap iron for building ships, their engines, etc., the question arises, what is to become of the fleet of the Golden Hope—where will they sail, who will buy them? At present there is work enough for one ship yard to meet the demand for steamers in Nova Scotia alone. Not only are the old wooden steamers which plied between Prince Edwards Island, Nova Scotia and United States ports being replaced by new iron vessels, but new lines of trade are being opened up. The western and southern shores of Newfoundland, Labrador, Prince Edwards Island, the outports of Nova Scotia, all are being rapidly connected by lines of steamers, and the projectors are finding their pioneer boats too few and too small.

Why should the gulf coal-carrying trade not be in the hands of those who are also shareholders in the Nova Scotia coal mines and fac-

ories, and why could not the provincial ship's husband tend with equal success the freights of this class of vessel, succeeding by the inexorable laws of progress to the more interesting sailing vessel of his youth? Iron barges, propellers, river boats; the great lakes and the St. Lawrence, should absorb many a ton of iron ore and coal, to provide transportation facilities. Along the coast there are required tug boats, launches, and coasting steamers for the lumber and pulp mills, the lobster factories, the fishing stations, the West India trade and all the industries that spring up when assured of regular and cheap transportation. And as even yet sailing vessels find a vocation in certain trades, an iron built or a composite ship will secure a market, or yield a return at least equal to that received from the same class of vessels elsewhere.

Already in the Pictou district there are foundries, forges and shops engaged in the construction of engines, boilers, etc., and very slight changes in plants would permit the construction of an iron steamer of moderate tonnage, the pioneer of a fleet equal in speed, strength and capacity to those now engaged in our waters but moulded and riveted from provincial iron smelted from provincial ores, and owned and navigated by the successors of those who built and sailed our wooden fleets.

Natural Gas in Ontario.

At the meeting of the American Institute of Mining Engineers held in Ottawa last October, a paper was read by Mr. Chas. A. Ashburner (since deceased) on "Natural Gas Explorations in the Eastern Ontario Peninsula," by which he meant the Niagara district. This paper contains observations on the relation between petroleum and natural gas, and on petroleum and gas in Western New York, but the part of most interest to us is that referring to explorations for gas west of Niagara river. Mr. Ashburner, having been a leading expert in these matters, and therefore to be considered as, in some sense, a public man, we think we may be entitled to criticise his remarks, notwithstanding that he has unfortunately died since this paper was read. Mr. Ashburner came to the conclusion, among other things, that "little hope can be entertained of finding gas in commercial quantities in the Trenton limestone under the Eastern Ontario (Niagara) Peninsula," also that "it cannot be expected that gas would exist in any of the strata in commercial quantity unless the gas-reservoir stratum is covered with at least 400 feet of superincumbent strata; nor can it be expected that gas will be found in any two or three different strata in the same well." Now, we do not see any ground for the first of these statements. We do not see why gas may not be found in the Trenton group under the Niagara Peninsula as well as in Ohio or anywhere else. Mr. Ashburner shows that in the region in question this group is 677 feet thick, including the "Quebec limestone" which, however, is a formation we do not know anything

about, and it certainly does not exist in Ontario. As to the second of the conclusions referred to, we fail to understand why the author has placed the requisite thickness of superincumbent strata at this particular figure. We should think that more depends on the nature of the strata than on its thickness, and that 400 feet of some kinds of rocks would be more than sufficient, while of others this would be far too little. A comparatively thin band of impervious shale or clay, if firmly compressed by other strata, would be sufficient to hold down the gas.

The St. Catharines well which was sunk for gas to a total depth of 2,200 feet was not a success, but the section thus obtained through the different formations will be of much value or future reference for geological purposes. By combining the results obtained in the wells bored for gas at Buffalo, Port Colborne and St. Catharines, Mr. Ashburner thinks the most likely horizons for finding it are the upper part of the Medina and the lower part of the Salina formations.

Since the time of Mr. Ashburner's visit to this district, Mr. E. Coste is said to have obtained gas in two wells, half a mile apart, about midway between Welland and Fort Erie, but in what quantities we have not been able to ascertain. Early in the present winter Dr. Bell, of the Geological Survey, was consulted as to the prospects for obtaining natural gas by boring at Forest, on the line of the Grand Trunk railway, and just south of Kettle Point on Lake Huron. As this place is underlaid by gas-producing rocks, and lies directly in the line of the Cincinnati anticlinal, he had no hesitation in encouraging the proposal to bore. The result was that gas was struck at a very moderate depth in the first well sunk. At first the pressure was very strong, but we understand it has since diminished considerably. The wells at Kingsville in Essex county are situated upon the same line, which Dr. Bell had laid down distinctly upon Logan's geological map a considerable time before the first well was started at Kingsville, and he had fully described the course of this line in his paper on "The Petroleum Field of Ontario," read before the Royal Society of Canada on the 27th of May, 1887, and published in full in the REVIEW. If, therefore, any credit is to be given for laying down this line it is clearly due to this gentleman.

The Future of Nickel Steel.

Some most remarkable statements, of great interest to the steel trade, were recently made by Mr. S. J. Ritchie, of Akron, Ohio, the well-known head of the Canadian Copper Company owning the celebrated Sudbury mines. It is understood that Mr. Ritchie visited last summer the principal iron and steel works of Great Britain and the Continent, and that the following statements are based on his investigations:—
"Within the last year nickel has come to assume a very important place in metallurgy as

an alloy with steel. These results have been obtained in Great Britain, in France and in Germany. In France the cartridge shells are made of an alloy of equal parts of nickel and copper. In Great Britain large guns for the navy are being made of an alloy of nickel and steel. This has also been done in an experimental way in Germany, but heretofore and before the discovery of the nickel deposits in Canada, the supply of nickel was so small and the price so high that it would have been impossible to have supplied any considerable want, even had its utility been known. The Iron and Steel Institute of Great Britain is composed of the most prominent manufacturers of steel both in Great Britain and upon the Continent, and it has at its meetings many American manufacturers. The discussions at its annual meetings represent the best talent and skill in everything pertaining to iron and steel that is to be had in the world, and its conclusions are the highest authority to which we can appeal. About one year ago this institute appointed one of its most competent members, a manager of the Steel Co. of Scotland, to make an extensive series of experiments with this alloy. This he did, and reported the results of his efforts to the meeting of the institute, held in London, May 8, 1889. This report has attracted the attention of steel manufacturers all over the world. No results approaching the high elastic limits and breaking strain of those reported from this alloy had ever before been seen. I myself saw a piece of this steel, made by the house of William Jessop & Sons, of Sheffield, which contained about six per cent. of nickel, and which was one inch square, that sustained a weight of 108 tons, and also showed a high elastic limit. These results were so wonderful that parties in Europe, who manufacture guns and armor plates for three principal governments, have offered to contract for our companies' entire production for a period of ten years. The proportions of copper and nickel in the ores belonging to our mines are just about those used by the French Government in the manufacture of cartridge shells. The proportions of iron and nickel are about what are used in nickel-steel, which it is proposed to use in the manufacture of guns and armor plate."

Wire Rope Fastenings.—In a paper read before the American Society of Mechanical Engineers, by Mr. Wm. Hewitt, a description is given of the behaviour of the fastenings which were employed in making tests of wire ropes. When using ordinary spliced-in thimble it was found that the strain elongated the thimble, forced one end past the other, which cut one or more of the strands so that the rope almost invariably broke in one of the splices. With conical sockets the rope pulled out under a strain, varying from one-half to three-fourths of the breaking load. A cast steel rope, two inches in diameter, was tested with socket fastenings prepared in the usual way with the addition of an annular wedge driven in around the core, with the result that the wires pulled out of the socket about three-quarters of an inch, and the rope then broke under a load of 266.250 pounds, being 71½ per cent. of the tensile strength of the individual wires of which it was made. The method of capping ropes in Britain is noticed, and it is suggested that the fastening might be made more secure by employing nuts to force up the rings which surround the joint.

LETTERS TO THE EDITOR.

Public Museum for Ontario.

Toronto, 20th March, 1890.

SIR,—At last Toronto appears to be awakening from its long torpor in relation to popular and practical science. With everything to boast of as to situation, intelligence, wealth and material progress, it is one of the few great cities of the world without even an approach to what is worthy of the name of a museum. The Province of Ontario is rich in minerals. Few countries are so favored. Here in the east we have apatite, marble and iron—to the west are apparently inexhaustible stores of petroleum and salt—at the north lie the richest deposits of nickel that are known to exist anywhere! Not to mention European cities, if we look at those of the United States, Australia, New Zealand, Tasmania, Chili and the Argentine Republic, we find there vast collections of the mineral products of the several countries—even Costa Rica has its national museum; but Toronto has none. Outside of Ottawa, the best geological collection is said to be in the small town of Elora, some fifty or sixty miles west of Toronto. A few specimens collected by the Ontario Mining Commission are on exhibition at the Canadian Institute, but what a paltry display for so great a yield. Toronto requires a first class collection in the interest of education as well as in that of material development; for the student as for the miner; for the tourist as for the prospector; for the citizen as for the foreign capitalist.

The Ontario Government threw away a splendid chance to move along the right line when it sent the beautiful specimens shown at Philadelphia, to an obscure hiding place at the Falls of Niagara—specimens too, which some of those who presented them assure us were given only upon the understanding that Toronto was to be the place of exhibition.

It is now freely acknowledged that the eye is one of the best mediums through which we can receive instruction, and while this holds good relative to other departments of human knowledge also, our plea has reference chiefly to the products of the quarry and the mine. Ontario is proud of her educational system, but here there is a yawning gap.

Again, for utilitarian purposes a museum has no equal. Here should be seen samples of all that is yielded by the country, and in connection with the collection one should be able to procure reliable information regarding location, output, percentages, routes of travel, markets, prices, profits, losses, and the hundreds of other particulars that practical men want to know. It should resemble neither a toy-shop nor a raree show, but ought to be purely and solely an illustrative, industrial mining bureau. Every day that Ontario lacks an institution of this sort, she is losing tens of thousands of dollars, and our only fear now is, that should the present agitation bear fruit, the fruit will be so politically sown as to be unpalatable.

There is no room in an institution of this kind for soft-handed hangers-on, and the head should be a man who knows the country, who knows his business, and who will earn his salary.

Yours, etc.,
"PROSPECTOR."

A Canadian Mint.

MONTREAL, 19th Mar., 1890.

The Editor.

SIR,—I have looked over the reports of the recent debate in the Senate on this subject. The speech of the mover (the Hon. Mr. McInnes) displayed a singular want of acquaintance with the real position, in confounding silver and gold together.

I don't believe the statement that five or six per cent. is lost in sending gold to San Francisco, or that there is a similar loss in sending it from Nova Scotia. Gold dust is not gold, and there are various degrees of fineness which would account for the larger part of the five or six per cent.

Silver is a different matter. The United States have made an enormous profit on silver by what is practically swindling the public, that is, by issuing eighty cents worth of silver and calling it a dollar. They have done this on an immense scale. But things must surely right themselves some day. It would be just as easy to make the same amount of money by issuing eighty cents worth of gold and calling that a dollar. That, however, would be instantly detected and would right itself at once.

The silver fraud is now going on, and the cure of it is a slower operation.

I am rather surprised to find that our own Treasury makes money out of silver. I never heard of this before, and am not acquainted with the circumstances.

I am, yours etc.,

GEO. HAGUE.

[We should say that the Canadian profits derived from silver coined during the year ended 30th June last amounted to \$52,774.21. The earnings of the U.S. mints from all sources during the same period aggregated \$10,351,701.47, while the expenditure and losses of all kinds amounted to \$1,502,665.60, leaving a net profit of \$8,849,035.87.—EDIT.]

Phosphate Analysis.

LONDON, Eng., 27th Feb., 1890.

The Editor,

SIR,—Supplementing my preceding letter of Jan. 13th, I call your attention to a printer's error concerning the ammoniacal solution of the mixed chlorides of magnesium and ammonium employed in Maret's method of estimating phosphoric acid; where the quantity of carbonate of magnesia should be 80 grammes instead of 8.

The following is the method of estimating iron and alumina in mineral phosphates, and adopted by Maret, of Paris.

The whole of the sample is reduced to a fine powder as in the previously described operation, and 2 grammes, carefully weighed, are introduced into a small flask with 15 cent. cubes of strong hydrochloric acid. (If the sample be rich in iron and alumina, say over 5 per cent., then 1 gramme will be found sufficient.) The contents of the flask are maintained in ebullition for a few minutes, then diluted with about 30 cent. cubes of distilled water, a crystal or two of chlorate of potash added and ebullition continued until the greater part of the free chlorine be eliminated. Filter into a precipitating beaker; the volume of filtrate should not exceed 350 cent. cubes after due washing. When quite cold add 2 cent. cubes of glacial acetic acid, followed by liquid ammonia, drop by drop, and with stirring, until the appearance of a permanent precipitate; a weak solution of ammonia is then added until the whole possesses a distinct, yet faint alkaline reaction; further, add 2 cent. cubes of glacial acetic acid and allow to stand a few hours. The clear liquid is then decanted through a filter, the precipitate follows, and the filter is allowed to drain. Return the precipitated phosphates to the beaker, employing a little dilute hydrochloric acid (water 9 to acid 1) to remove last traces from the filter, and to redissolve the precipitate in the glass. A second precipitation similar to the first is now effected, except that one half a gramme of neutral phosphate of ammonia is added to the liquid previous to the treatment with ammonia. After standing a few hours the whole is filtered on the same filter as employed in the previous operation, and the collected precipitate is duly washed with distilled water, drained, dried, and afterwards calcined at dull red heat. It consists of the mixed phosphates of iron and alumina:—



This residue is treated in the same capsule which served for the calcination, with a few cent. cubes of hydrochloric acid, the excess of which is subsequently evaporated by application of a gentle heat; take up with water and introduce the solution into a small flask to be there reduced to the lowest state of oxidation by pure zinc and sulphuric acid—the titration of the iron is then ascertained by permanganate of potash as usual. The quantity of iron found being calculated into $\text{Fe}_2 \text{ P}_2 \text{ O}_8$, this latter is then deducted from the weight of calcined residue, above mentioned, and the phosphate of alumina thereby ascertained, and from which the weight of the alumina ($\text{Al}_2 \text{ O}_3$) is deduced. This method is fairly rapid and practical.

I am, etc.,

J. LAINSON-WILLS.

New York, March 7th, 1890.

The Editor,

SIR,—I am very greatly interested in the discussion which has arisen in your columns upon the letter addressed to you on the 17th November last by Capt. R. C. Adams. Will you excuse me if I ask permission to occupy in connection therewith, a small portion of your valuable space?

In the January "REVIEW" Mr. J. L. Wills, after describing what is known as the "Maret" process for determining the phosphoric acid in phosphate ores, says, "I have thoroughly tested this process myself, and find it reliable and expeditious!" In the February "REVIEW," Mr. J. T. Donald, after explaining that the chemists of the world are "almost a unit" in using the "Molybdate" process, remarks, "I am surprised to see Mr. J. L. Wills advocating the method of analysis he outlines in the January REVIEW! The method, which is uncertain, and likely to give too high results, has for some years been almost universally discarded in favor of

the Molybdate method." In the same issue of your journal, Capt. R. C. Adams returning to the charge, and replying generally to his commentators, observes, on the subject of the analysis, that, "his (Mr. Wills') prescription of Maret's method of analysis is said by our best authorities (?) to be defective."

Now, sir, I am very curious indeed to discover, if possible, upon what or whose authority Messrs. Adams and Donald make their sweeping charges against this so-called "Maret's method?" Can they justify it themselves on any truly scientific grounds? Can they point out in the method, properly conducted—any inherent source of error? I do not believe they can!

During the past three weeks the whole of the fertilizers and phosphate rocks sent to this laboratory have been analyzed in duplicate. The determinations of phosphoric acid have been made—simultaneously and with equal care—by the Maret and the Molybdate methods. The following results are selected from our agenda:

Date.	Serial No.	Nature of Material.	Maret's Method.	Molybdate Method.
February 1890.	1.	Mixed Fertilizer.	13' 270	13' 247
	2.	"	10' 111	10' 105
	3.	"	18' 900	18' 900
	4.	Bone Black.	31' 130	31' 320
	5.	"	28' 700	28' 530
	6.	Bone Meal.	29' 150	28' 970
	7.	"	28' 630	28' 640
	8.	S. Carolina Rock.	26' 420	26' 310
	9.	Canadian Apatite (ground).	37' 000	37' 200
	10.	"	39' 640	39' 511
	11.	"	32' 185	32' 300
	12.	"	40' 320	40' 321
	13.	Refinery Residue.	29' 100	29' 410
	14.	Acid Phosphate No. 3.	13' 150	13' 200
	15.	S. Car. Phosphate (ground).	26' 000	25' 799
	16.	"	27' 300	27' 270
	17.	Florida Phosphate Rock.	32' 200	32' 600
	18.	"	34' 190	34' 189
	19.	"	16' 930	16' 900
	20.	"	24' 740	24' 732

The figures speak for themselves. If they serve no other purpose, they may stimulate the gentlemen I have named to further investigation, and thus teach them the folly of intemperate and ill-considered denunciation.

Yours etc.,

FRANCIS WYATT, PH. D.

The Geological Maps of Nova Scotia.

HALIFAX, March 19th, 1890.

The Editor:

SIR,—At the risk of being thought a "damned insane visionary," as a silver-tongued statesman once called the first miner who proclaimed the discovery of gold in Nova Scotia, may I add to what you say in the CANADIAN MINING REVIEW for November and February another reason for continuing the publication on a larger scale of the Geological maps of Nova Scotia.

That this province, with an area of only 17,500 square miles, one-fifth of which is occupied by lakes and arms of the sea, supports one-tenth of the population of the Dominion, and from mines scattered over every part of its surface yields more than one-fourth of the total annual production of minerals in the Dominion, or ten times that of the neighboring province of New Brunswick, (which has an area of 28,000 square miles), has made it so well known that geological map-making seems to be the best if not the only scientific work which the Geological Survey can find to do.

Its history has been written by Judge Haliburton (Sam Slick), Brown, Murdoch, Campbell, Longfellow and Bourinot, and is the history of the early settlement of North America from Europe. Its geographers are Church and Mackinlay, Gisborne, Mackenzie and Murphy. For the language of its aborigines we have Dr. Rand's Micmac Dictionary; for their folk-lore, Leland's Algonquin Legends. In archaeology and ethnology there are books by Patterson, Gilpin and Piers; and the social life and habits of the people may be studied in the novels of Haliburton, Pro-

fessor De Mille and Cozzens. The game and fish of the forests and streams are described by Hallock and Capt. Hardy; the scenery of the lakes and mountains by Howe and Roberts, Osgood and Morton, Warner and Farnham, whose descriptions are brightened by photographs, sketches and paintings such as those by Mason and others who follow the annual pilgrimage of tourists to the beautiful shores of the Bras d'Or Lake and Bay of Fundy.

And of observers in natural science there are names of eminence and authority. In botany and zoology, Professor Lawson, MacKay and Morrow, Drs. Gilpin and Sommers; in meteorology, Allison and Poole; in mineralogy and chemistry, Professors How, Harrington and Marsh, Alger and Jackson and Mr. Gilpin, the head of the department of mines; in palaeontology, Sir William Dawson, Professors Hart, Salter, Owen and Hall, Leidy, Billings, Davidson, Matthew; in general and descriptive geology, Sir William Logan, Sir Charles Lyell, Gesner, Brown, Campbell and Fletcher, Drs. Honeyman, Selwyn, Hunt and Ellis; in reports on special mining districts and geological formations, Poole, Gilpin, Rutherford, Hamilton, Hartley, Routledge, Barlow, Barnes, Robb, Heatherington, Professors Hind, Lesley, Chapman, Sillimon, Browne and Lyman. An abstract of many of the conclusions which fill thousands of pages of valuable contributions to science from these and other observers is contained in Dawson's Acadian Geology, a large book of 800 pages.

Since, therefore, the Geological Survey cannot do better what has been done by all these specialists, its aim should be to correlate their work and extend it when done in isolated localities.

To miners, explorers and those engaged in scientific research in a mining district, maps are of the first importance. This was clearly and strongly stated in a report on the gold-fields of Nova Scotia made in 1871, by the present director of the Geological Survey, who, while admitting that the various country maps (usually published on a scale of one mile to an inch) show accurately the course of the roads and the general outline of the streams and lakes in their vicinity, points out that "the want of even approximately correct topographical maps of the gold districts is a serious hindrance to their development . . . and to the progress of geological investigations . . . and every dollar expended towards their production eventually becomes an annual saving to the country." In 1881 he began, conjointly with the Provincial Government, a survey of these gold-fields, which comprise nearly one-half of the superficies of the province, to prepare for the use of prospectors a general map for which "after careful consideration a scale of half a mile to one inch was decided upon as the most suitable." Since that time, although the grant from the local government was soon discontinued, the survey has been carried on by Mr. Faribault, who has made a good map of the country east of Halifax which is now to be issued on a scale eight times as small as that decided upon as the most suitable, although, about a year ago, the director recommended that the provincial government "might be asked to assume the extra outlay involved in publishing on the larger scale." This outlay would not of course be nearly as great as the cost of one of the small scale sheets multiplied by the number of sheets on the large scale embraced in it, for the minuteness of detail in the former, requiring greater skill and care on the part of both draughtsman and engraver to make it even approximately correct, would add largely to its cost.

Yours, &c.,

A MINE MANAGER.

Canadian v. Italian Asbestos.—Mr. James Boyd, managing director of the British Asbestos Company, who can speak with an experience of ten years in Italy, writes to the London papers respecting the New Asbestos Company which has been formed to develop certain French and Italian properties as follows: "I have recently heard that a Canadian asbestos property has been acquired by the company holding the greater part of the Italian properties, or by parties interested in it. They could raise hundreds of tons from their Italian properties; and if they do not do so there must be a reason for it, and I believe the reason may be sought for in the fact that, whilst Canadian asbestos fibre can easily be spun into thread fit for manufacturing into rope or cloth, Italian can only be so spun on a commercial scale by the admixture of cotton, or some other material, owing to the want of cohesion amongst its fibres. Owing to the increasing steam pressures used in connection with triple expansion engines, a great increase has taken place in the consumption of packings made of asbestos cloth, and I believe it is practically impossible to make this of pure Italian asbestos. The English Admiralty have, I believe, persistently refused to put Italian asbestos packing on their list, for the reasons above stated. * * The protective tariffs, so called, in France are not so high as to prevent both Italian and also English manufacturers of Canadian asbestos goods from selling their manufactures there; and as a matter of fact, the prices in France are lower than in England."

PHOSPHATE.

In General.

The economical use of the most appropriate turnip manure was the subject of a paper read before the Strathogie Farmers' Club the other day by Mr. Wm. Scott, Corliestone, Scot. The author recounted the results of a number of experiments carried out on his farm at the instance of the Highland and Agricultural Society, who supplied the manures. The specific questions which the experimenter sought to settle were: 1st, Should the phosphate be soluble or insoluble? 2d, Should the phosphates consist of bone, mineral phosphates or Thomas slag? 3d, Should nitrogenous manure be soluble or insoluble, or a mixture of these? 4th, What proportion should the phosphates have to the nitrogen? For this experiment the kind and qualities of the different manures used were as follows: (1) Fine bone meal, 50 per cent. phosphates, and 5 per cent. ammonia. (2) Dissolved bones, 16 per cent. soluble phosphates, 21½ per cent. insoluble phosphates, and 3 per cent. ammonia. (3) Ground Charles-ton phosphate, 57 per cent. phosphates. (4) Super-phosphates, 29 per cent. soluble. (5) Thomas slag, 38 per cent. phosphates. (6) Organic manure, 7 per cent. ammonia. (7) Sulphate ammonia, 24½ per cent. ammonia.

For this experiment 10 plots of land of one-fortieth of an acre were required, as uniform in quality as possible, so that each might get the same chance for a crop. The quantities of manure were so arranged that each plot received the same amount of phosphates and ammonia, viz., 5 lbs. phosphate of lime, and ½ lb. ammonia, *i. e.*, at the rate of 200 lbs. phosphate of lime, and 20 lbs. ammonia per acre. These are the amounts of phosphates and ammonia contained in 400 lbs. bone meal which was applied to plot 1. The manures were used along with about 18 yards good rich dung, and the seed—Sittyton Aberdeen green top yellow—was sown on June 12th, the plants being carefully singled (on which the weight of the crop largely depends) on 20th July at 8 inches apart. Mr. Scott sums up the results of his experiments as follows:

Plot of 1-40th of Acre.		Total Weight of Tops and Bulbs per Acre.	
No.	lbs. bone meal...	T.	C. Q. LB.
No. 1-10	lbs. bone meal...	31	1 1 20
No. 2-13½	lbs. dissolved bones...	32	17 0 16
	— 1½ lbs. organic manure...		
No. 3-9	lbs. ground phosphates...	32	1 1 20
	— 7 lbs. organic manure...		
No. 4-17	lbs. superphosphate...	30	10 0 0
	— 7 lbs. organic manure...		
No. 5-13½	lbs. Thomas slag...	32	2 3 12
	— 7 lbs. organic manure...		
No. 6-7	lbs. organic manure...	30	2 3 12
No. 7-17	lbs. superphosphate...	34	17 0 16
	— 3½ lbs. organic manure...		
	— 1 lb. sulphate ammonia...		
No. 8-17	lbs. superphosphate...	32	10 0 0
	— 2 lbs. sulphate ammonia...		
No. 9-17	lbs. superphosphate...	35	1 1 20
	— 1½ lbs. sulphate ammonia...		
No. 10-17	lbs. superphosphate...	38	14 1 4
	— 1 lb. sulphate ammonia...		
No. 11-18	yards dung and no manure...	33	14 1 4
No. 12-18	yards dung and 5 cwt. No. 1 tur- nip manure per acre...	42	14 2 4
No. 13 -18	yards dung and 5 cwt. special mix- ture per acre...	43	2 3 12

That soluble phosphates are preferable to insoluble phosphates Mr. Scott considers the experiments have clearly brought out, and he believes it would be much more economical if much less manure were given to the turnip crop at one time, his view being that it would be more desirable not to put in what is necessary for the whole rotation with the turnip crop, but that it would be better to supply the plant food year by year, a very considerable saving being by this means effected.

Some American fertilizer manufacturers formed a pool recently to contest the State's right to impose an annual license tax of \$500 on each brand sold in North Carolina. The Farmers' Alliance propose to boycott all firms which refuse to pay the tax unless they do so under protest. This, it was thought, had settled the matter, but now there are new developments. The American Fertilizers Company, of Norfolk, Va., which had refused to pay the tax, and whose goods had been seized by the Department of Agriculture, have entered an action for a mandamus to compel the State Treasurer and Commissioners of Agriculture to issue licenses to any company, though said company should offer to pay the tax under protest. The position taken by the company is that the tax is unconstitutional, unjust and unequal in its operation, by compelling small manufacturers to pay as much on a single

brand as large dealers. The company also claims that a tonnage tax would be the only just one and that manufacturers would not object to it. It proposes to carry the matter to the United States Supreme Court. The State now derives about \$40,000 revenue from this tax.

Markets.

An English correspondent writes—The phosphate market is dull at the moment, as is customary at this time of the year, for manufacturers are busy delivering their fertilizers, and don't want to turn their attention for the moment. Sales, therefore, are not brisk; but prices are well maintained. Somme, 75 % (ground), being 17d. per unit, with ½d. rise and 70% 15d. with rise ex. c.i.f. London, as compared with 11d. and 10d. respectively 26 months ago. In fact, I see no chance of high grades falling in price owing to the small supply and increasing demand; but, on the other hand, I do not think much increase is probable. I should like to call your attention to one fact, viz., that though four years ago, when the market for fertilizers was at about the lowest point, 400,000 tons of Basic Slag and 150,000 tons of Somme phosphate—equivalent to 300,000 tons of super-phosphate—were thrown on the market, yet this enormous increase in the annual supply (700,000 tons) has been more than digested; for, as you know, prices of various phosphates have risen from 25 to 50%, and Basic slag has risen from 32/- to 52/- per ton. In fact the demands for slag greatly exceeds supply, and the use of this slag on lands where fertilizers had never been used has led to an increase in the use of super-phosphates.

Company promoting has been very slack of late, not owing to the scarcity of money but rather on account of the high bank rate.

Our latest quotations are:—Canadian 80% sold at equal to 16d., with ½ rise basis London delivery—an advance of 40% on last year's prices. Somme, 70 to 75%, selling at equal to 1/3¼. London terms, and 75 to 80%, at 1/5¼, with rise, but little on the market. Belgian scarce, and only a little 40 to 45%, and 45 to 50% available. Aruba and Curaçoa off the market. Cambridge about 50/-, but nothing offering.

Templeton District.

At the McLaurin mine, machinery is being placed, and as soon as the snow is off the ground operations will be begun on three lots. Lately only a few men have been employed, and these principally in making preparations for future work.

At the Blackburn, the owners are taking out phosphate at the rate of 15 tons per day, and expect to do so from this out right along, and better when the dry weather sets in. About 1,300 tons, representing the winter's work, has already been hauled down.

Kingston District.

The probabilities point to a large quantity of phosphate being mined in this district during the coming season, for beside the mines already at work quite a number of new properties will be worked as soon as the weather is settled. The great drawback to the district is poor roads.

The Foxton mine, which lately has been a bit off color, is now yielding as well as ever, for after sinking a few feet, a large body of rich ore was struck and operations are now being conducted on a large vein twenty feet in width.

Mr. Webster's mine at Gould Lake is working in a small way, and making an output of from three to four tons per day. The working force will be increased shortly.

At the Hibbert mine, near Sydenham, principally "dead" work has lately been done, but the pits are reported to be looking well and in good shape to mine with rapidity and economy.

Lievres District.

At all the mines on the river mining operations go on much as usual, and there is really nothing of special mention to report. All the pits continue to produce satisfactorily, and when navigation opens there should be an increase on previous years in the quantity of tonnage to go forward.

The new machinery for the Dominion Phosphate Co. (of London) has arrived at the Rapids and will soon be in place and at work.

Mr. P. H. Smith, manager of the High Rock mines, writes to say that the output from his pits, during February, was fully one hundred tons over the average, and that the mines never looked better than they do to-day.

The output from the new pit at Little Rapids, since the beginning of the year, has been sixty tons, with an average force of three men—a very creditable showing indeed.

MINING NOTES.

Nova Scotia.

At the annual meeting of the shareholders of the Inter-Colonial Coal Mining Company (Limited) held a few days ago in Montreal, the following directors were elected for the ensuing year:—Messrs. Gilbert Scott, Henry A. Budden, Peter Redpath, Robert Anderson, James P. Cleghorn, Alexander Gunn, W. M. Ramsay, H. S. MacDougall and Thomas Wilson. At a subsequent meeting of the board, Messrs. Gilbert Scott and Henry A. Budden were re-elected president and vice-president respectively, and Mr. W. J. Nelson reappointed secretary-treasurer of the company.

Darr's Hill District.

It is rumoured that Mr. Geo. W. Stuart has sold all of his interest in the famous Dufferin mine, and will devote his attention this year to the development of his valuable property in Killag district.

Central Rawdon.

Bills to incorporate the "Central Rawdon Mining Co., Limited," and the "Northup Mining Co., Limited," have been passed in the Nova Scotia Assembly. Returns from these companies for February are not yet at hand.

Waverley District.

The cross-cut tunnel which has been driving under Laidlaw's hill the past year has been stopped. It had attained a length of 460 feet and had cut several veins, but none were recognized as the "barrel quartz" vein to prospect which was the object of the tunnel. It is probable that work on the tunnel will be resumed shortly by another syndicate.

The Lake View Mining Co. have decided to proceed immediately with the erection of mill, probably of 20 stamps. The No. 6 vein in this property is enlarging going east, and now has a width of about 18 inches. The "Taylor Twin" Lode keeps its width of 24 to 26 inches. The management are still driving on the lode cut west of the fault, which is believed to be the Dominion lode of West Waverley. This lode has a width of from 10 to 14 inches, and at present is deemed worth \$40 per ton.

Mt. Uniacke District.

The Phoenix Co., after thoroughly cleaning up the openings in their mine and testing the dumps, begin this month the mining and crushing of fresh material taken from the stopes. The management are confident that the present year's work will demonstrate the feasibility of working low grade ores at a profit.

Caribou District.

It is rumoured that the Lake Lode Co. are at last going to add five stamps more to their present five-stamp battery. If, as the manager says, their vein is 12 feet wide and worth \$10 per ton, such a mining policy is entirely incomprehensible.

The property of the Truro Gold Mining Co. in this district is looking well, and as soon as the weather will permit, active developing operations will be commenced.

Stormont District.

The old "North Star" lode has been reclaimed by Mr. H. K. Fisher, of the Palgrave Co. The water has been pumped out and the incline retimbered, and mining operations will be carried on there the coming summer. The mine has been equipped with a new boiler and engine, with hoisting and pumping gear, and a large boarding-house built within 100 yards of the mine.

Oldham District.

The sale of the Oldham Gold Co.'s property has been postponed, by order of the Supreme Court, until May 3rd.

Goldenville.

Returns from this district continue to be of a spasmodic character. Nothing more has been heard of the rich strike reported last September as being found in the

eastern part of the district. During February 150 tons were crushed from the western part of the district (on the old Sutherland property), which yielded at the rate of \$9.50 per ton. Properties here are held at too high a valuation to induce the investment of capital.

Lake Catcha.

The Oxford mill is again running, with abundance of quartz ahead. The mill has been temporarily shut down to permit the cylinder of the engine to be re-bored and other parts refitted. The management report a very satisfactory saving of fuel as the result of the improvements.

Quebec.

Work in the asbestos region has been pushed with customary vigor during the past month, but the weather has been such as to throw back the production considerably. The miners are, however, looking forward to the opening of spring, and extended operations when the weather permits. As is usual at this time of the year, there is a plentiful supply of labor.

At Thetford, the different mines are working their customary force.

Messrs. King Bros. have placed an order with the Jenckes Machine Co., of Sherbrooke, for a duplicate of the plant supplied by that firm to the United Asbestos Co. (limited), Black Lake; the machinery is to be in position by May 1st. Messrs. King Bros. expect to largely increase their output during the present year.

We are informed that Mr. George R. Smith, now with the Ingersoll Rock Drill Co., has about completed arrangements with Mr. A. H. Murphy for working the property of the Thetford Mining Co. on contract this coming summer. This mine was equipped with boiler and steam hoist last fall, but by the time the machinery was put up the mine was closed for the winter.

Messrs. Lucke and Mitchell, with the other parties interested jointly in the "Wells Lot," have given an order for some machinery, which will be placed early in the spring. They propose enlarging the openings started last summer, and which show a splendid bunch of veins. The work will be in charge of Mr. H. J. Williams, New Rockland.

At Black Lake, the pits are all in operation.

The American Asbestos Co. (limited) have completed their tunnel and rise. The tunnel was driven 160 feet, and the rise is 59 feet high. They are now sinking No. 2 pit, and have no anxiety about water when the spring break-up comes. Mr. Ed. Wertheim, managing director of the company, is on the ground. About 140 men and boys are employed at these pits.

The United Asbestos Co. (limited) have their machinery in operation, and it is giving good satisfaction. At present but two drills are being worked at their pits, but we believe it is their purpose to increase the number as soon as practicable. A third pit is being opened, and derricks are to be put up at once.

The Anglo-Canadian Asbestos Co. (limited) are working their usual force. Some additional machinery will be added to their plant in the spring.

Messrs. Steele, and McDonald Bros. are erecting a building on their Lot.

Gold Mining Supplies.

The principal depot in Nova Scotia, carrying the most complete assortment of first class goods, is

H. H. FULLER & CO'S,

41 to 45 Upper Water St., Halifax, N.S.

Our line comprises Explosives, Fuse, American and English Mill and Hammer Steel, Bar and Bolt Iron, Steel Wire Hoisting Rope, Hemp and Manilla Rope, Rubber and Leather Belting, Miners' Candles, Oils and Lamps, Miners' Tools, Machinists' Tools, Blacksmiths' Tools, and every requisite for the gold miner.

H. H. FULLER & CO.,
Halifax, N.S.

Prospecting on the Lots of the St. Julie Mining Co. and the Black Lake Mining Co. is being carried on with moderate success. Some nice samples have been taken from the latter.

Mr. John McCaw, of the Brompton Lake Asbestos Co., writes to say that he expects to have all the machinery in place at the mine and ready for work by the end of the month. A small force has been employed since the 22nd January in prospecting operations. Mr. McCaw states that five tons of low grade sent in to the Cyclone mill, at Montreal, yielded 7,682 lbs. of merchantable asbestos; the result of this test is satisfactory, as the company will be able to utilize all the short fibre, which hitherto has been thrown upon the dump and lost.

The price of crude asbestos continues to have an upward tendency, a sale by the Johnstone-Irvine Co. of one hundred tons having lately been made at one hundred and twenty-five dollars per ton. Messrs. King Bros. are also reported to have sold a similar quantity at one hundred and thirty dollars per ton, delivered on the cars at Thetford.

The Wolfestown Mining Company shipped, during last year, one hundred and fifty tons of soapstone.

At the mines of the Bristol Iron Co., Pontiac Co., good work continues to be done under direction of Capt. Symons. The following telegram, under date of 12th inst., from the consignees in Pennsylvania, speaks for itself as to the quality of the shipments being made from the mines: "Your ore is turning out splendidly; twelve cars last sampled and analysed show over 63 per cent. metallic iron and .005 phosphorus."

Ontario.

The Sydenham Mica and Mining Co. continue active operations on their mica mine. The output, which recently has been somewhat below the average, is improving again, and your correspondent is informed that the turn-out will soon be up to the old standard.

A fair quantity of mica is being produced from the Grant mine, near Sydenham. A cutting-house in connection therewith has been opened at the village.

Madoc District.

The lease of the Powell gold property, in the Township of Marmora, to a Mr. Taylor, manager of the Flinton gold mine, is reported, but at present no work is being done.

The Consolidated mines, at Delora, and the Richardson property, at Eldorado, are at present idle, with no good prospect of being re-worked very soon.

Large contracts have been made by the lessees of the Crookston quarries to supply the city hall, Toronto, and other public buildings with heavy limestone for the foundations and more solid parts. From 100 to 150 men will be employed as soon as the boarding houses are completed.

Port Arthur District.

The vigorous prosecution of the railway into the mining district has brought from the far south not a few American capitalists, who are interesting themselves in investing, and what is better, arranging for the development of recently acquired properties. Many shanties are being built, outcrops uncovered, trails cut, and other preparations are being made for extensive work.

The Board of Trade has been busy urging upon the Government the urgent necessity of a remission of the present onerous tariff on imports of such mining machinery as is not manufactured in the Dominion. A memorial has also been presented to the Local Legislature pressing for the issue of patents for lands surveyed on Hunter's Island, and also to empower local agents to dispose of applications for lands without the tedious delays now incurred in referring such to headquarters.

At the Shuniah Weachu, developments of late have been such that the stock still continues to rise in the English market. It is reported that Capt. Tretheway is about to resign. From his long and intimate acquaintance with some of the most celebrated mines, and his practical knowledge of mining plants, he would be the right man in the right place as Mining Inspector under the new Act—so thinks our correspondent.

The diamond drill at the Beaver has been down 1,600 feet, and is now operating from the surface of the ground where the Beaver vein, when produced, will form a junction with the North Bluff vein. The veins will be tested at various other points. The drill will also make tests

from the Beaver vein to the Big Harry vein. Captain Williams is timbering up the stopes, and has eight completed. It is estimated that there are 20,000 tons of milling and shipping ore ready to be stoped. The engineers are pushing the mill, and it will be ready for the spring work. The capacity of the mill is 25 head of stamps; this power is being doubled, and will probably be trebled if matters are as satisfactory as they are believed to be. As soon as the mill starts, 30 tons of ore will be hoisted per hour. There is some 3,000 tons of mill rock on the dump.

On the 20th ulto., the Badger Silver Mining Co. declared a second dividend of twenty-five cents per share (or five per cent.), payable on the fifth day of March. It will be remembered that, about two months ago, this mine declared a dividend of ten per cent., and that, previously to that, they had made an assessment and then returned it, so that inside of six months they have actually paid dividends upon a mining capital of \$250,000 to the extent of twenty-five per cent. The mill of the company has been shut down owing to cold weather, but a shipment of ore will be made early this month, which will likely be the last until May, when regular shipments will again commence. From last accounts, the mine is looking as well as ever. The management seem more than pleased with the country; and it is hinted that early in the summer they may take hold of no less than three other large mining enterprises, all in this part of the country.

The West End is working only a small force at present; but there is no diminution in the richness of the ore extracted.

The Crown Point has been doing further development at the west end of their vein. It is reported that an interest has been sold at a big figure, and that the force will shortly be doubled.

Operations at numerous prospects continue active and promising, and the iron deposits along the P. A. D. & M. Railway are being uncovered and tested at numerous points.

The Elgin has 200 feet of sinking, 425 feet of drifting and 75 feet of cross cuts finished. The main vein is four feet wide and will yield all the way from 30 to 600 ounces to the ton. It has not yet been touched except for the purpose of testing the drifts being made alongside of it. A force of men is working in No. 1 end to connect with No. 2 shaft, and it may be said that no piece of property shows better results and prospects for the amount of time and money expended upon it. It is now under the supervision of Capt. Hooper of the Beaver—Mr. James Emmons having charge of the men.

Sudbury District.

It is estimated that there is being daily produced at the Canadian Copper Co.'s mines about 90 pot loaves or matte, each weighing 450 lbs., an output which yields an aggregate of more than 4,000 tons of nickel a year.

Rat Portage District.

At a recent meeting of the stockholders of the Rat Portage Reduction Works Company, held at Winnipeg, Mr. R. T. Riley was appointed trustee for the Winnipeg stockholders, and the appointment of Messrs. Drewry and Riley on the directorate was confirmed. The manager reported that work on the building was progressing favorably.

Mr. R. Sims, president of the Canada Mining and Reduction Company, reports that rapid progress is being made with the construction of the new reduction works at Rat Portage. It is expected that the building will be completed and the machinery in position about the first week in May.

North-West Territories.

Advices from Lethbridge state that there are good prospects of a decided increase in the production of coal from the Galt mines during the coming year. It has been decided to sink an air shaft to connect with No. 1 ventilator, and sink and timber two new shafts down to the coal bed. Two boarding houses, providing for one hundred men, will be ready for use early next month, and if necessary, further accommodation will be provided for a large increase in the working force. The superintendent states that the company has decided to raise the output from the inclined plane to 500 tons, and that from No. 1 shaft to 400 tons per diem. More men are required for work in the mines, and also for the construction of the railway extension.

Mr. E. T. Galt states that the N. W. C. N. R. has leased their railway to the Alberta Railway and Coal

Co., and that work on the extension of the boundary will commence as soon as the frost leaves the ground.

A Special General Meeting of the Canadian Anthracite Coal Company was held at Ottawa on 20th inst. The following directors were present:—Hon. J. G. Thorp, Cambridge, Mass.; Mr. Macleod-Stewart, Ottawa; Mr. L. Painter, Menomine, Wis.; Mr. A. Pugh, St. Paul, Minn.; Mr. Coffin, Eau Claire, Wis.; and Messrs. A. Stewart and L. Crannell, Ottawa. The meeting was called to consider certain proposals from an English syndicate to acquire and work the mines of the company at Banff, N.W.T.

The Alberta Railway and Coal Company have assumed the property of the North-Western Coal and Navigation Company, Limited, and extensive preparations are now in progress to increase the colliery output at Lethbridge up to 1,000 tons daily before 1st October next, this being the date when their new railway to Great Falls, Montana, is to be completed. The length of this railway—guage 3 feet—will be about 200 miles, 70 miles being through Canadian territory. The surveys are now well advanced, and the contractors, Messrs. Grant and Ross, are at work on the American side. It is understood that grading will shortly be commenced at the Lethbridge end of the road. Contracts have already been awarded at Lethbridge for the sinking of two additional shafts and air shafts in connection therewith, and building operations for the accommodation of miners are very brisk.

British Columbia.

A letter received by the Vancouver *World* from Barkerville, Cariboo, under date of the 13th inst., speaking of the burning of the Government chlorination works, says the origin of the fire is not known; but it appears that on Monday the workmen were thawing out some of the pipes, and the supposition is that a smouldering spark did the damage. About 10 o'clock Monday evening, W. C. Price, who was left in charge, and sleeps in the engine-room, went through the building, as was his custom before going to bed, to see that everything was all right, and noticed nothing wrong. About 4.30 the next morning he was awakened by the roaring flames, and tried to get into the chlorinating-room, where the fire appears to have started; but could not, on account of the flames. He then went to some miners near by to get assistance, but the fire was beyond control, and the whole buildings were completely swept away.

At the adjourned general meeting of the Perry Creek Gold Mining Company, it was decided to issue a \$75,000 extension of the capital stock, and a number of the new shares were at once spoken for by the present shareholders. The remainder of the new stock will be placed in the hands of Bourchier, Croft & Mallette for negotiation. Several fine nuggets of Perry Creek gold are at present on exhibition in the cabinets of the firm named.

From the annual report of the Minister of Mines for the year ended 31st December, 1889, we learn that since 1858 the estimated total yield of gold and silver amounted to \$52,236,753. Last year's gold product was of a value of \$588,923, of which \$490,769 were known to have been exported by the banks, leaving some \$98,154 as having been carried away in private hands. The estimated yield of silver was \$47,873. The number of miners employed was 1,929, their average yearly earnings reaching \$330.

The quartz industry of the province has made most gratifying progress during the past year. English and American capital has been attracted into the Kootenay, Cariboo and Yale districts, and a large amount of development work has been done. Smelters for the treatment of ore have been erected at Vancouver and Revelstoke. Kootenay district has received the greatest attention during the year, that section adjacent to the line of the C.P.R. and the Kootenay Lake region in particular. From the Kootenay mines, silver ore of exceedingly rich character has been forwarded to the smelters of Helena and Butte for treatment, with excellent results, though the cost of transportation has been very heavy. Machinery for treating gold quartz has been taken to several mines. With the building of necessary railways and the establishment of rapid and cheap communication with the outer world, Kootenay Lake district gives promise of becoming one of the richest mining regions on the continent.

A Movable Platform for Inclined Planes in Mines.—The object of this arrangement is to make connection between the rails of steep inclined planes, worked by engine power, and those of intermediate level roads which branch off them to each side. It consists of

an angle iron frame, having two horizontal top bars, one on each side of the incline rails, and at the same level as the branch road rails. On one of the top bars is hinged a malleable iron plate after the manner of a trap door in a floor. When this plate is in a vertical position, in which it is kept by a counter-balance weight, it blocks the branch road, and the trains on the incline are free to pass up and down. When the plate is lowered to a horizontal position, it rests on both of the top bars, and its upper end touches the incline rails, and so forms a connection between the branch road and the incline.

The Gold Miners' Association.

The second Annual Meeting of the Gold Miners' Association of Nova Scotia was held at Halifax on the afternoon of the 4th inst. Some important changes in the by-laws were ratified, and the following office-bearers elected for the ensuing year: President, Mr. George W. Stuart, Truro; Vice-president, Mr. J. M. Reid, Oxford Mines, Lake Catcha; Secretary-Treasurer, Mr. T. R. Gue, Halifax. After a short discussion upon the geology of the gold fields, and an address from the retiring president, Mr. B. C. Wilson, the meeting was adjourned until the evening, when the annual banquet was held in the Halifax Hotel. A number of the invited guests were present. The following is a copy of the very unique (and horribly indigestible) bill of fare:

ANNUAL BANQUET.

Halifax Hotel, March 4th, 1890.

—MENU—

SOUP.		
Nitro-glycerine, with Noodles of Stearine Candles.		
FISH.		
Boiled Winze.	Fillet of Cross-cuts.	Fried Skips.
ENTREES.		
Arsenical Pyrites, a la Frue Vanner.		
Amalgamated Plates, Quicksilver Sauce.		
Air Drill Croquettes.		
REMOVES.		
Roast Quartz, stuffed with Nuggets.		
Stamp Batteries, with Amalgam Jelly.		
Retort Gold, Borax Dressing.		
Boiled Bullion, U. S. Mint Sauce.		
GAME.		
Baked Whin, with Poverty Dressing.		
Waverley Tunnel, Barrel Quartz Sauce.		
SALADS.		
Floured Quick Salad. Assay Office Mayonnaise.		
VEGETABLES.		
Mashed Fusees, with Damp Caps.		
Fried Upraises.		
Boiled Back Staples.		
Sweet Dynamite.		
PASTRY.		
Jumbo Plum Pudding, Pennyweight Sauce.		
Oxford Breaks.		
Rawdon Bricks.		
Dufferin Pie.		
Wine Harbor Jelly.		
Pick Cheese.		
Shovel Crackers.		
DESSERT.		
Pinched Lodes.		
Pickled Dies.		
Candied Tappets.		
Buckets.		
Shoes.		
Ropes.		
Sheaves.		

Duty Trials of Pumping Engines.

Purchasers of pumping engines often stipulate that they shall give a certain "duty" before they are taken off the contractor's hands, and in cases in which the duty is likely to fall short, disputes sometimes arise between the builders and the experts making the trials as to the allowance to be made for certain things—as to whether the duty is to be calculated on the actual quantity of water delivered or on the plunger displacement; whether any allowance should be made for the friction of water in the pump passages and pipes; and in the case in which the boilers are not supplied by the same contractor, and the evaporation of so many pounds of water is fixed as being equivalent to the combustion of one pound of coal; as to whether the pound of coal is to be taken as the equivalent of the water evaporated from the temperature of the feed water in the pond; also as to whether only dry steam should be charged against the engines, and also to what allowance, if any, should be made for steam consumed by the feed pump engine. The methods of gauging the condition of the fires at the beginning and end of the trials are open to variation in the practice of different individuals, and the reports are not made so that a fair comparison can be instituted between the different engines. "Without doubt," the author concludes, "many of those unsatisfactory features are due to the fact that duty trials are often conducted by civil engineers whose training and experience does not qualify them for expert work of this character, and such tests, while they may be perfectly sincere, cannot be regarded as authoritative.

Concentration of Low-Grade Ores.

(By Henry F. Armitage, Lake City Colo.)

The object of this paper is to give a few useful hints on the concentration of low grade ores. The machines that I shall speak of are Cornish rolls, revolving screens, Hartz jigs, spitz-lutte, and the Linkenbach buddle, (or Roberts's patent buddle as it is called in Colorado). I think the reason why some of them have been discarded in favor of more recent inventions is that they have not been given a fair chance to do their work in a satisfactory manner.

Cornish rolls are usually looked upon as a machine designed simply to crush the ore as a preliminary to sending it to the sizing-screens, beyond which they have nothing to do with dressing the ore. On the contrary the rolls give the key-note to the whole process. It is well known that one class of rock will crush differently from another, and from the result obtained by passing the ore through the rolls, the size of the first revolving screen and the surface required on the jig-screens must be determined. If it is found that the mineral crushes clear from the quartz, a large mesh can be used on the first sizing-screen, and the tailings will not require recrushing; but if it is found that some of the tailings from the first jig are ragged, (that is, are carrying off particles of mineral sticking on the quartz,) it will be necessary to recrush them. Again, if a large percentage of the tailings carry off mineral, it will be more economical to commence with a finer mesh screen than to recrush the tailings.

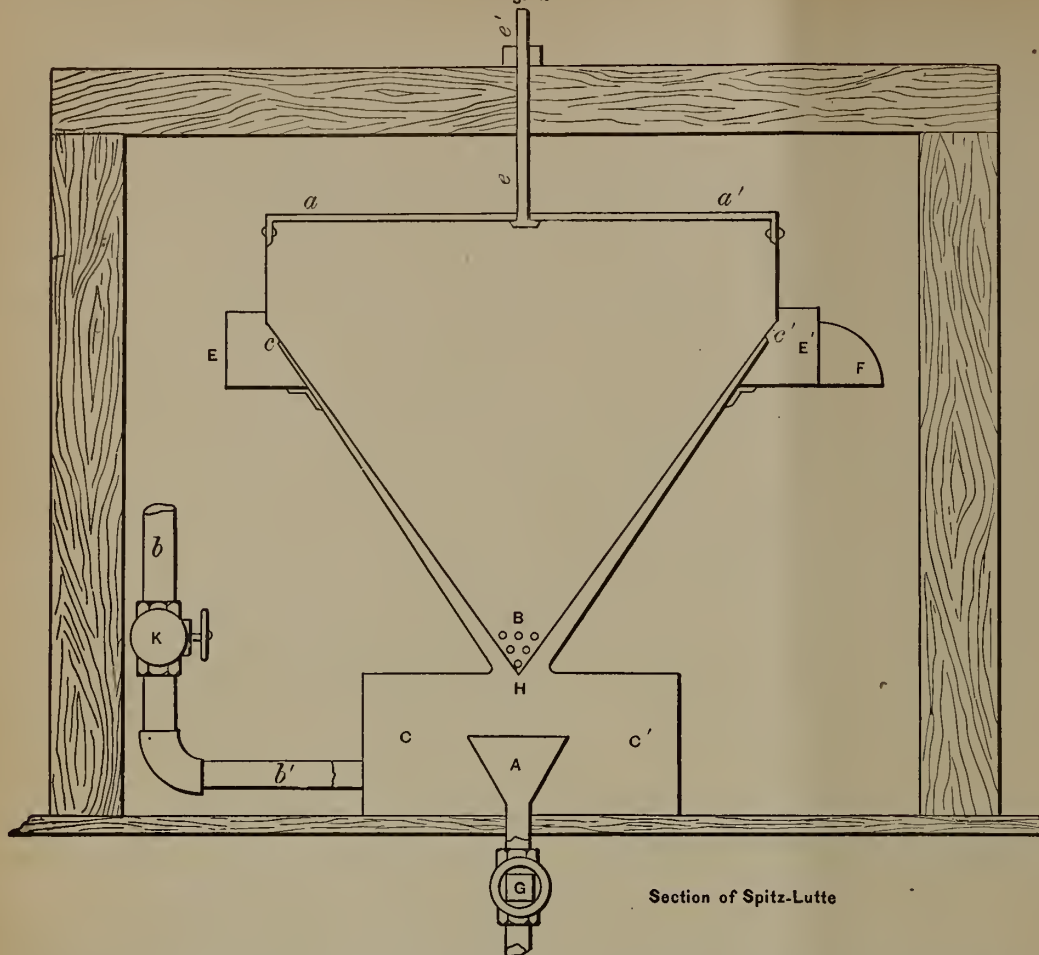
Having determined the best mesh to use on the first sizing-screen, the different sizes on the other screens can be determined from it. I have found for practical purposes that, commencing with a 6-mesh, the next should be 8, then 12, and finally 18. The holes in the jig-screen should be a trifle larger than in the revolving screens. For instance, if the revolving screen is made of No. 14 wire, the corresponding jig-screen should be of No. 16 wire. The jig-screen surface required for each size made depends on the way the ore crushes in passing through the rolls, and this is shown by the quantity of crushed ore passing through each revolving screen. Supposing, for example, that the sizings are 6, 8, 12 and 18, and it is found that 40 per cent of the crushed ore passes through the 6-mesh screen, 15 per cent through the 8-mesh screen, 15 per cent through the 12-mesh screen and 30 per cent through the 18-mesh screen; then, if three-compartment Hartz jigs are used, it will require two three-compartment jigs to treat the ore from the 6-mesh screen, one three-compartment jig to the eight, and one three-compartment jig to the 12-mesh. The 18-mesh jig catches everything that is fine enough to pass through the 18-mesh revolving screen, and it is necessary to separate the finer slimes from the ore before it is allowed to go on the jig. I have found that a spitz-lutte does this work most satisfactorily. As I have not seen one in any other mill in Colorado, I present a sketch of this very simple machine.

It consists of two inverted cones, one inside of the other. The inner cone is suspended from a frame by a threaded bolt fastened to a cross-brace, *aa'* on the cone. The outer cone rests on the dead water tank, *cc'*. The ore and slimes after passing through the 18-mesh revolving screen, run into the inner cone and pass through the perforations, *B*, at the bottom, into the space between the two cones. Here they encounter an up-current of water coming from the pipe *bb'*. This pipe is connected with a tank at sufficient height to give the required head. The finer slimes are separated and washed out at the point *cc'* where they run into the trough, *EE'*, surrounding the outer cone and are carried to the buddle-table by the spout *F'*. The heavier particles of mineral and quartz fall into the hopper, *A*, and are drawn off by the stop-cock *G*, on to the jig. By raising or lowering the inner cone, by the screw and nut *ee'*, the space at the point of discharge can be increased or decreased. It is essential that this space should be of the same area as the area of the space at the point *H*, so that the up-flow of water will be of uniform velocity from the starting point at *H* to the discharge at *cc'*. This flow is regulated by the valve, *K*, and by it the quantity of slimes sent to the buddle-table can be controlled. The stop-cock *G*, is kept open only sufficiently to let the ore that falls into the hopper *A*, run off to the jig.

This machine will take off all the slimes and let the ore of proper size go to the 18-mesh jig, the quantity being about 20 per cent of the ore crushed. As this ore, being very fine, takes longer to settle and pass through the jig-screen than the coarser sizes, I find it better to increase the number of compartments on this jig. This refers to ores that contain galena, gray copper, yellow copper, and iron pyrites, and from which it is necessary to save and separate these minerals. In doing this on a three compartment jig, I found the copper minerals and pyrites were crowded out at the tail-gate before they had time to settle and pass through the jig-screen. But if the ore has to pass over five or even six compartments before reaching the tail-gate, it has had time to settle through the beds and the tailings will be clean.

The Linkenbach buddle was fully described in a paper by Mr. Richard F. Rothwell, read at the Boston meeting

Fig. 1.



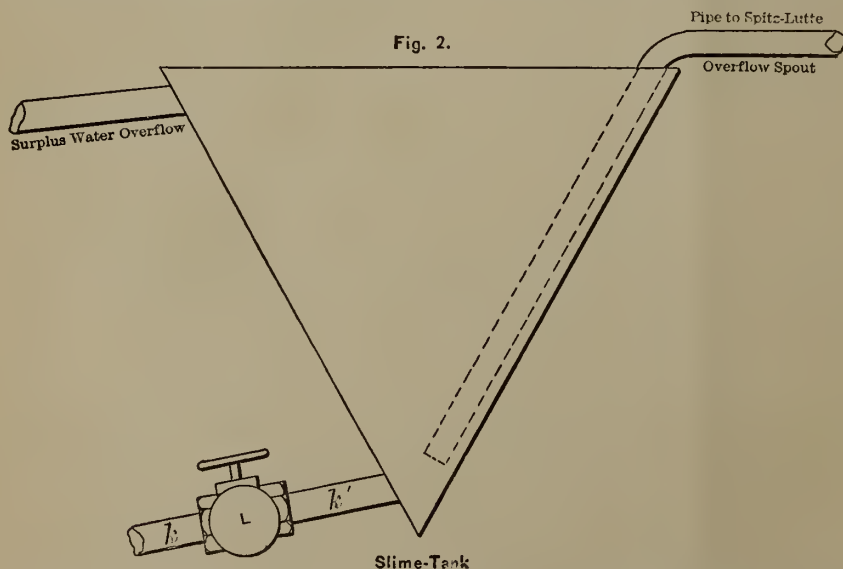
Section of Spitz-Lutte

Feb. 1883, (*Trans.* xi. 475). It is a stationery table with rotating water sprays, which I consider an excellent apparatus for treating low-grade slimes, but like jigs, it must receive fair treatment to be able to do its work well. The slimes as they come from the spitz-lutte carry too much water. The whole of the water used on the revolving screens, together with that used in the spitz-lutte for washing out the slimes, would run on the buddle and prevent it from doing its work as it should. To prevent this excess of water from reaching the buddle, I let the slimes run into a hopper-shaped tank and draw them off from this to the buddle. By making the slimes from the

I do not think it is advisable to increase the number of strokes when the stroke is shortened; that is, to run the finer jigs at a higher speed than the coarser ones, as this has a tendency to disturb the bedding, though I believe it is done in many cases.

In bedding the jigs, the best plan is to bed each compartment with the same ore which that compartment is going to handle. In treating an ore containing galena, gray copper and iron pyrites, bed the first compartment with galena, the second with a mixture of galena and gray and yellow copper, and the third with yellow copper and iron pyrites. The bedding of each jig can be ob-

Fig. 2.



Slime-Tank

spitz-lutte discharge at the bottom of the tank, as shown in the accompanying sketch, very little can rise to the surface of the tank, and get away by the overflow, the slimes being sucked out by the pipe *kk*, as fast as they are delivered. The valve *L* must be left open sufficiently to allow the slimes to pass to the buddle without accumulating in the tank, the surplus water passing off at the overflow. The middlings from this table, consisting of the lighter ores, I carry to a Frue vanner.

The length of stroke given to the jig-plungers is a matter to be determined by experience. No rule can be given, since the difference of fit of the plungers in the jigs would change the effect of any given stroke.

tained from the headings of the preceeding jig. To obtain bedding for the first jig, put into the first sizing-screen a small section of larger screen. If the first screen is 6-mesh, put into the screen a strip of 4-mesh wire-cloth 6 inches wide, which will allow enough ore of the proper size for bedding to pass to the first jig and keep the bed supplied. This will save the time and trouble of having to crush and screen ore to make this bedding.

By close attention to the bedding on the different compartments, a perfect separation of the different minerals can be made. If the headings of the first compartment show any copper, the bed is not heavy enough, and if the headings from the second compartment show galena, the

bed on the first compartment is too heavy.

On the jigs use the least possible quantity of water to do the work, but be liberal with water on the revolving screens. The water in the jigs should be perfectly clear. If the jigs are muddy, slime is sticking on the ore, instead of being washed off in the revolving screen and going to its proper place on the buddle table.

DISCUSSION.

RICHARD PEARCE, Argo, Colo.—The subject of the concentration of low-grade ore is one of special importance to Colorado at the present time.

The State has hardly kept pace with other districts in that branch of mining industry. It has been customary for Colorado miners to sell their ores to the smelters in mass, just as it comes from the mine, but now the necessity for concentration is coming to be more plainly seen especially in the low-grade ores of certain localities, not favoured by cheap facilities for transportation to the smelters. It must be remembered, however, that in some instances concentration is accompanied with heavy loss in gold and silver. In the concentration of a mass of auriferous chalcopryite in a gangue of quartz in California, only 40 per cent. of the gold was saved, the valuable mineral being finally distributed in the quartz. As an example of the opposite character, the London mine, between Leadville and Alma, may be cited, where, in concentrating from 4 tons to 1, there was a saving of over 90 per cent. of the gold. The gold in this case was contained in the pyrite.

CHARLES J. MOORE, Leadville, Colo.—The results attained by concentration at Leadville are not entirely satisfactory, and the work is not thought to be good unless 80 per cent. or more of the lead is saved. The ores subjected to concentration are chiefly sulphides—pyrite, galena and blende. The silver occurs most generally in the galena and blende, not in the pyrite, except in those parts of the Leadville district where the ore occurs in fissure-veins, in granite country, or in porphyry dykes, in which cases I have noticed the pyrite often to be the principal silver-vehicle, or, at least, equal to the blende as such, the galena taking the third place both in quantity and relative silver value. In these veins also is found considerable rhodonite or manganese silicate, but, as a rule, this mineral shows little affinity for silver; it is often, however, impregnated with pure pyrite and nearly pure galena, the former in the largest quantity, as we should expect from the frequent association of manganese and iron.

The percentage of saving of silver is less than that of lead, seldom amounting to more than 60 p. c. This is explained by the fact that, owing to the objectionable behaviour of the blende in the furnaces, this mineral, carrying silver with it, is allowed to go into the tailings. The problem is, how to get rid of the blende and not lose the silver it contains; or how to save all the galena with the silver it carries, and not retain so much blende as to effect the cost of smelting unfavorably. If the crushing is extremely fine, silver is lost in the form of a light sulphide that floats on water.

At Aspen there is only one concentrating mill, that at the Molly Gibson mine. The ores contain a large amount of barite, not easily separated from the ore. In some of the Aspen mines there is considerable lead, but the ores are generally dry. The gangue of the ore in Leadville is partly quartz and partly siliceous dolomite; in Aspen the gangue is principally a changed dolomite. In some mines, however, those which carry lead, the gangue is the changed blue limestone, a rock which carries from 80 to 96 per cent. of CaCO_3 .

JOHN M. DESLOGE, St. Louis, Mo.—In connection with the subject of the concentration of low-grade ores, something may perhaps be learned from an account of the German-American practice at the old mill of the Desloge Lead Company at Bonne Terre, Mo. The mill was destroyed by fire in March, 1886, and the mine is at present a part of the St. Joseph Lead Company's property. I must therefore depend considerably on my memory for the facts and figures I am able to give.

The ore yielded on an average about 7 p. c. of a non-argentiferous galena, and 1 per cent. or more of cobalt-and-nickel-bearing pyrites. These minerals occurred in an almost non-siliceous, true dolomite, containing few or no fossils, and belonging geologically to the horizon of the Lower Silurian. The rock was impregnated unevenly throughout a stratum of many feet in thickness. Bodies of ore carrying 20 per cent. of galena were not unfrequently met with, but these richer portions were mixed with the leaner rock, for it was found that better results were obtained when the ore to be concentrated was kept at a nearly uniform standard. The ordinary products of concentration, aside from the waste, were two in number; one locally called "mineral," containing about 70 per cent. of galena and 15 per cent. of dolomite, with little or no silica, and a middle product, known locally as "sulphide," consisting of about 33 per cent. of galena, 33 per cent. of dolomite, 33 per cent. of pyrite, with something less than 1 per cent. of cobalt and nickel.

The ore came from the mine in $\frac{1}{2}$ ton cars, and was dumped by cradles provided with balance-wheels, by

means of which the empty cars were quietly and quickly righted. The ore fell in front of three 9" by 15" Blake crushers; originally, two of them were of the lever pattern and the other eccentric, but, after long use, the eccentric, not having two-thirds the capacity of the others, was replaced by one of a different pattern. In regard to the use of wrought iron jaw-plates, I can say that my attention has been called to an idle crusher fitted with such plates, whose appearance as to usage and wear seems to indicate the practicability of employing that material. The ore was broken so as to go through a 2-inch ring and thence directly to three pairs of 14" by 30" Cornish rolls, with chilled tires made of car-wheel iron. These usually wore from four to six months, but, at the time of the fire, there was one pair in fair condition that had been doing an average daily crushing of 80 to 100 tons a day of moderately hard limestone since the starting of the mill, about five years before.

The coarse rolls delivered a product of hazel-nut size, which was taken by a belt-elevator in buckets holding 10 pounds each to three sets of 9 mm. screens, 3' by 8'. All that was too coarse to pass through the screens returned to the rolls for recrushing. The ore that passed through fell upon three sets of 7 mm. screens, 3' by 6'. The screen-openings were all round-punched.

The sized ore between 9 mm. and 7 mm. went to three pairs of 2-sieved roughing-jigs with lever slot-motion, the speed being in proportion to the arc travelled. The stroke was $\frac{3}{8}$ inches with 100 revolutions a minute. The sieve-wire was No. 8. A Lake Superior Collom roughing-jig was, after some service, abandoned, though its work compared favorably with that of the other jigs.

The ore that passed through the 7 mm. screens went to water-currant classifiers, one for each screen. Here three classes were made: one from 7 mm. to 5 mm.; a second from 5 mm. to 3 mm., and a third below 3 mm. The ore of size between 7 mm. and 5 mm. went to twelve roughing-jigs, of the same pattern as those previously mentioned, but with No. 15 sieve-wire instead of No. 8. The stroke was $\frac{5}{8}$ of an inch with 120 revolutions a minute. The ore between 5 mm. and 3 mm. went to Hartz, or eccentric-jigs. Of these there were two sets of four each with three sieves of Nos. 15 and No. 20 wire. The stroke was $\frac{1}{2}$ inch, with from 150 to 200 revolutions a minute, according to the ore.

All the jigs in this portion of the mill had the automatic cap-discharge from the sieve. The roughing-jigs had, approximately, a capacity for treating 25 tons in twenty-four hours; the eccentric-jigs a capacity of 12½ tons. The product known as "mineral" was obtained from the first compartment of the jigs, and generally, also, from the first hutch-boxes. The product from the second compartment of the roughing-jigs was usually recrushed, but that from the second compartment of the eccentric-jigs working on the stuff between 5 mm. and 3 mm. constituted the "sulphides." The product of the third compartment was recrushed and subsequently treated in another part of the mill.

The two sets of Cornish rolls for recrushing were of the same pattern as those previously mentioned, but they were run at about double the speed, making 25 revolutions a minute, and crushing 40 tons, more or less, in twenty-four hours. The product of these rolls went to a 3 mm. screen. The part that was too coarse to pass through the screen was returned for recrushing. That which passed through went to two sets, four in a set, of 3-sieve eccentric jigs, from which "sulphide" and some "mineral" were obtained. The tailings or "chats" went to settling-tanks and were thence delivered into side-dumping cars and hauled away by a locomotive running on a track of 3 foot gauge. The slimes and tailings were handled in the old mill, where there were a set of rolls, a screen, two roughing and two eccentric-jigs, two Evans and one Coggin table.

These tables were adopted after an exhaustive competition with Ritinger side-bump tables. Their capacity was at least five times that of the Ritinger tables, and they gave nearly as clean a product; they required less power and less attention, used no more water and showed less wear. The tables were used for treating slimes from the settling-tanks. Each table could treat about one ton an hour, making 60 to 80 revolutions an hour. One table was used with fair results, to treat the waste slimes of an old settling-pond. The headings of the tables were clean, and the middlings went to light-bumping tables or vanners for higher concentration.

The rated capacity of the mill was 300 tons of mine-rock in twenty-four hours, and the average work was 250 tons. The water used amounted to 1200 gallons a minute. The mill gave employment to about 33 men, including those needed for loading the tailing-cars, but not the engineers or firemen, who were engaged also for a part of their time on mine work. The approximate cost of milling was 40 cents a ton.

The breakers required the service of about 14 men. From my knowledge of the Gates crusher I am of the opinion that, for the same capacity, they would not need more than one-quarter the number.

The rolls for recrushing the finer material did not give satisfaction. The loss was about 30 per cent. on a 10

per cent. galena. This loss was due to the presence of dolomite, to which particles of galena adhered, or of fine galena which was washed away in the tailings. There was great need of pulverizers and slime concentrators that would do good work and have large capacity. Several pulverizers were tried but without success. A single-head steam stamp-mill, constructed on the principles of the Rand drill, was tried, but that failed.

For fine grinding, the Heberle mill, used by those who adopt the Lake Superior practice, and for slime concentration, buddles of the Evans pattern, with light-striking tables to take the buddle middlings, seem to me worthy of consideration where such losses like those at Bonne Terre occur. The old mill was started with 15 mm. screens; but in the other mill, where it was planned to discard down to 7 mm., less attention was given to screen-sizing, and more to the work of the roughing-jigs.

In milling our extensive deposits of low-grade ore with a low price of lead, it was commercially important for us to decide on the most economical practice, and to determine whether it were better to treat rapidly a large tonnage, even at a loss of 30 per cent. or more, or to work with a higher per centage of saving on smaller quantities. In the former case, one screen-sizing may be the best, as is the present practice of the St. Joseph Lead Company; but, in my opinion, what these ores require is two screen-sizings, the first to not over 7 mm., and the second to some finer size (unless the screen is replaced by some other modification of sizing apparatus), and good grinding and sliming machinery.

Free Importation of Mining Machinery.

In the House of Commons on 26th ulto:—

Mr. PLATT moved:

That machinery designed for use in mining operations should not be subject to Customs duty when imported into Canada for mining purposes.

He said: I desire to state that it was not at the instance of any party or parties interested in the introduction of mining material, free of duty, into this country, that I placed this motion on the Order paper. I became aware on several occasions last year that efforts were made by parties interested in the importation of mining material, to induce the Government to admit that material free of duty. I also became aware of the fact, which every hon. member I suppose is aware of, that the mining industry, although at present an infant industry in this country, is just about entering upon a period of development far beyond what many of our people realise. The vast, and I may say, illimitable mining resources of this country are becoming more and more apparent to the people, and we are looking forward to the day when the mining industry of Canada will be second in importance only to the agricultural industry. When we look over the geological map of this country, and when we read something of its mineral resources, we cannot but look forward with pleasure to the day when Canada will be *par excellence* the mining country of the world. I believe it is the duty of the Government, particularly at this time, to give every encouragement to those who are trying to develop those vast resources, and it is that view alone which has induced me to place this motion on the paper.

Mr. MARA: I am very glad to see that there are other portions of the Dominion, as well as the Province of British Columbia, which are agitating in favor of the free admission of mining machinery. Last Session, the hon. member for Cariboo (Mr. Barnard) brought this matter before the House and clearly proved that the machinery required to get out our refractory ores is not manufactured in the Dominion. He also clearly showed that the manufacturers would not suffer by the free admission of this machinery, that at present mining machinery is practically barred from entering into the Dominion, and that, if it were admitted for two or three years free of duty, the manufacturers would have a much larger market than they have at present. Since last Session, the attention of the Minister of Customs has been repeatedly called to this question by the Provincial Government, by the different Boards of Trade, and by the press of the Province, which, although divided on every other subject, is united on this. We cannot understand why that gentleman will not yield to the representations which we have made. We consider that, in a matter affecting the tariff, we have a strong claim upon the Dominion Government. We pay a very large sum yearly into the Dominion Treasury. Last year we paid in duties of Customs and Excise, \$1,100,000, nearly five times as much as the Province of Prince Edward Island, 50 per cent. more than Manitoba and the North-West Territory combined; and, estimating our population at 100,000, exclusive of Indians, we pay more than twice as much per head as any other Province in the Dominion. In a matter of this kind, affecting an infant industry, we contend that, where we can show that it will not injuriously affect any other industry, the Government ought to yield to so reasonable a request as we have made. Situated as we are, so far from the manufacturing centres of Ontario and Quebec; having to pay

a very heavy toll upon all manufactured goods taken into the Province, whether they are from Ontario or from Quebec, from the United States or from England; being, as far as manufactured goods are concerned, consumers rather than producers, the tariff presses heavily upon us. When the National Policy was framed, it was intended to protect every interest and to assist every industry. The farmer of Ontario is protected by the duty on his coarse grains and root crops; the manufacturer of Ontario or Quebec is doubly protected, first, by a high tariff on all goods manufactured into the Dominion, and secondly, by the admission of such raw material as is required for manufacturing purposes and is not the product of Canada; the coal-miner of Nova Scotia is protected by a duty of 50 cents and 75 cents a ton on coal; the iron industry of Nova Scotia is also protected by a bounty; but you will look in vain for any single article which is protected for the benefit of British Columbia, and on the free list there is not a single article intended to foster or encourage any industry in that Province. Since the discovery of gold on the Fraser River, British Columbia has produced over \$50,000,000 of gold. Almost the whole of this has been in quartz diggings. The placer mining has not been successful, and the miner has devoted his attention to quartz, which will give more employment and be of greater benefit both to the Province and to the Dominion. In prosecuting his search for quartz, he has, to a large extent, been successful. Large bodies of low grade ore have been found all over the mainland of British Columbia. In the district of Kootenay, along the line of railway, mining development has been retarded, largely owing to the mining belt being practically locked up in a dispute between the two Governments. That, I am happy to say, is settled, and we may soon look for an era of prosperity in that section. But when we take the far-off district of Cariboo, as well as the southern and western district of Kootenay, districts almost inaccessible, far removed from roads and trains, where the cost of transportation is high and living expensive, the miners and prospectors have had many difficulties to contend with. In regard to the southern district of Kootenay, that portion to which I now call the attention of the House, if hon. members will look on the map they will find that it is bounded on the south by the States of Montana, Idaho and Washington, and is only separated by an artificial or imaginary boundary line. These districts are rich in gold, silver, copper and lead; and the large output of coal and silver, chiefly from the States, has contributed greatly to the wealth of the United States during the past few years. The prospectors of quartz, labor under difficulties that the ordinary miner has not to contend with. The miners who are working placer diggings, or hydraulic mines, have, by their own individual efforts, or aided by mining companies, succeeded in working their mines, but with the quartz miner it is different. It takes years of labor and a large outlay to get a quartz mine successfully opened, and even then the capitalists have to step in before any successful working can be done. In that portion of Kootenay bounded by Montana and Idaho, the topographical features are somewhat similar to those of the States I have mentioned. The formation of rock is the same, and, as might have been expected, the miners, in their march northward across this artificial boundary, have discovered large bodies of low grade ore, and mines which will equal any of those in Colorado, Nevada or Idaho. Last year, in visiting that section of the country, I obtained a list or memorandum of shipments of ore from a few of the mines there. To show the state of development of these mines, I will read returns from the different smelting companies of the shipments of ore from that section:

Silver King....	70	230 silver,	20 p. c. copper.
No One.....	146	87 "	
Little Donald..	85	90 "	35 p. c. lead.
Spokane.....	65	40 "	70 "
Della.....	20	120 "	
Sky Line.....	15	225 "	
Krao.....	12	95 "	50 p. c. lead.
Gallagher.....	14	110 "	\$14 gold.

Mr. CHARLTON: I suppose these yields are in each case so much per ton?

Mr. MARA: In each case per ton; and I may say they are authentic. Several of the returns I got from the mine owners, and the others were furnished me by the Gold Commissioners. Now, you will see that these returns are not samples from a few ounces of rock, but returns from shipments of hundreds of tons. It may be said, that where the rock will yield such a large return, there should be no difficulty in procuring machinery or capital necessary to work the mines; and so it would be, if these returns represented the whole of the ore extracted from the mines. But this ore, when run out from the tunnel, has to be picked up by hand experts. The freight alone from the Silver King Mine to Butte is \$33 per ton, and from the Hot Springs Camp to Helena, \$26.50 per ton; so that miners can only ship the higher grade ore, and instead of shipping it away, there is now lying on the dump hundreds of tons of ore that it will not pay to move for want of mining machinery. Here we have hundreds of tons of ore that, in treating, would give em-

ployment to a great number of men, and representing hundreds of thousands of dollars, but it is lying there idle, simply because the rates of transportation are so high, and the Government impose a duty upon mining machinery so high that such machinery cannot be brought into the country. I do not think a stronger argument can be used in favor of the Government yielding to the concession we ask. I visited another mine called the Blue Bell or Hendryx Mine. In that mine, I went down 100 feet below the surface, and traced a vein of ore 87 feet wide. The greater portion of this only yields from 4 oz. to 10 oz. in silver, and one small portion yields 20 oz. in silver and gives 50 per cent. in lead. Several shafts have been sunk on this mine, the ledge has been cut across in several places, and to-day there are thousands of tons of ore exposed to view. That mine can produce more galena and more lead than is to-day consumed in the whole Dominion of Canada; and I was informed by Dr. Hendryx, one of the principal owners of the mine, were the duty taken off mining machinery, their company would be prepared at once to put in a plant that would cost about \$200,000, and the machinery alone would cost \$100,000, but they are not prepared to pay into the treasury of the Dominion something over \$30,000 in shape of duty. In discussing this question with these mine owners, who are chiefly Americans, I said to them: Now, you are Republicans in your own country, you are protectionists; how is it that once across the line you throw your protectionist principles to the wind, and you cry out for free trade? Their reply invariably was: That is not the case. We were protectionists at home, and we are protectionists here. We believe in the policy of America for Americans, and we do not blame you for insisting on a like policy of Canada for the Canadians. But we say this: You do not manufacture in Canada the machinery requisite for the treatment of our ores, and even if you did manufacture that machinery, there is no means of our getting in the Ingersoll rock drill. Steam drills are manufactured in Montreal, but they could not get one in Montreal because they had no means of taking it in from our side, and this rock drill had to go in from the American side and had to pay a duty of 30 per cent. I was informed that, instead of that one drill, there would be a dozen drills in use in Kootenay if they could be taken in free of duty. I met there a very intelligent man from Spokane, a representative of Spokane capitalists, and in conversation with him I learned that the capitalists he represented would also put machinery on the different claims in which they were interested if the duties were removed from mining machinery. He was originally in a bank at Spokane; he is a man who has some knowledge of geology and assaying, and was selected by the Spokane people to select locations for them in the Kootenay country. I asked him to give me the benefit of his views in writing, which he did a short time after, and which, with your permission, Mr. Speaker, I will read to the House. He states:

"In relation to the benefits accruing to this section by the abolition of duties upon mining and reduction machinery, I have to state that were such a measure accomplished, I would within a year have a concentrator of from thirty to a hundred tons here, as well as at least two hoisting plants, and probably a quartz mill and other mining machinery such as machine drills, etc. I am positive that at least two others would do as much more, and I further feel confident that a very large and complete smelting plant would be erected; and, of course, with the advent of these industries the progress of this section would be apparent. At present we cannot obtain these things in the Dominion, and if we could, transportation to this point is at present impossible, and that renders protection in one case a hardship, without any industry being protected, hence nothing is accomplished favorable to any party. Our ores in the main are of such a grade that we must be able to mine and reduce cheaply to insure a profit, and the margin of profit is so small that machinery on any but one or two claims would not be feasible while duties exist and transportation is exorbitant. It is apparent, then, that great things must result with the energetic working of the claims, and a vast amount of industries incidental to extensive mining accompany and follow up the new era of prosperity, and, in my opinion, all it needs to bring on this state of affairs is a little fostering by the Government in the shape of duty rebates and better transportation."

I might say with respect to the question of transportation that that is a difficulty which, I believe, will very shortly be solved. Every northern trans-continental line is now seeking an entrance into Kootenay. The Northern Pacific are about to build a line from Kootenay to Bonner's Ferry, from whence a steamer can be taken to any of the mines on Kootenay Lake. The Spokane and Northern Railway Company has an application for a charter now before the House for a line running from the international boundary near Pew Doreille, and the Canadian Pacific Railway Company are applying for a charter from Sproat's Landing on the Columbia River to Nelson on Kootenay Lake. So the difficulty with respect to transportation will soon be solved, and it only remains now for the Dominion Government to say whether they will assist the mining industry by allowing mining machinery to be admitted free of duty. It may be said by members of the Government that the letter I have read, as well as the information I have furnished, is from American sources. I admit that; but I will say this, that it is only through American enterprise, industry and capital that that section of the country has been opened. However, the same feeling pervades every other part of

the province, namely, that unless the duty is taken off mining machinery, very little advance can be made in mining industry for years to come. A few days ago, I read a letter published by a resident of Victoria, a representative of British capital to the extent of \$500,000, and the representative of a company which is doing good work in developing the mines of Nicola, in which the matter was put very clearly. I may add that he is a supporter of the Government, and a Conservative, and, being an Englishman, he, John Bull like, goes straight to the point and strikes out from the shoulder. I will read an extract from his letter. After referring to the work done in the Nicola country, he says:

"You might assist that development by more vigorously and persistently pressing for the removal of the practically prohibitory duty levied by the Dominion Government on mining machinery, without which the mines cannot be worked. The situation at present is this: The Province which owns the minerals acts most liberally to those engaged in mining. It gives them away to whoever discovers and prospects them. It makes trails and roads to render mining districts accessible. It does all this without deriving any revenue, except small sums from miners' licenses and record fees, which do not begin to recoup it for its large and generous outlay. The Dominion, which does not own the minerals, but which would gain the lion's share of benefit from a mineral development, through its heavy tariff neutralises the efforts of this Province by prohibiting the working of the mines unless it first receives a toll of 30 per cent. of the value of all machinery necessary to extract the minerals from them."

"To show you how this operates I will instance Nicola, and what applies to that district applies to all others in the Province:

"The ores of Nicola are refractory. They consequently require far more expensive machinery to treat them than free milling gold ores, which, except at and near the surface, have not yet been discovered in British Columbia. This means a large outlay and the payment of about twenty thousand dollars to the Dominion for the privilege of working Provincial mines that the Dominion never owned. I know that outside capitalists look upon this Dominion 30 per cent. tax on mining machinery as little better than a black-mailing operation, and they prefer to invest in semi-barbarous countries, such as South Africa, where they are not plundered of a portion of their capital before they have a chance of investing it, as they are at present if they venture into the Dominion of Canada."

"My opinion is that an output of precious metals from the quartz mines of Nicola and other mining districts of British Columbia will be delayed until the Dominion permits mining machinery to be brought in without the present preposterous duty being levied upon it. Every well-wisher of this Province should energetically protest the continuance of a tax which stops the investment of capital in mines and prevents the development of the greatest natural resource British Columbia possesses."

That is the opinion expressed by nearly every man, miner or otherwise, who has an interest in British Columbia. What we ask is this: that the Dominion Government should take the duty off such machinery as is not at present manufactured in the Dominion; and we contend that the manufacturers, instead of being injured, would be benefited by that measure. We say that such machinery as concentrating machinery, quartz mills, reduction mills, sampling mills, and refining works, are not manufactured here. So our request is a very fair one. We ask that the Government will take the duty off that class of machinery for a short time, and we further ask that they will remove the duty from all machinery, including motive power, in that part of Kootenay at present inaccessible from our own side. I venture to predict that in the district of Kootenay, if that policy be followed, inside of three years you will have a market for more mining machinery than is manufactured in the whole Dominion to-day.

Mr. BARNARD: I have submitted to the Minister of Finance a list of mining machinery which we hope will be admitted free of duty, and the greater part of which is not, I am quite satisfied, manufactured in Canada. I am in hopes, as all the members from British Columbia are, that the Government will be able to place some of these articles, if not all of them, on the free list. In the meantime I will defer making any further remarks on this subject, until the Minister of Finance has announced the changes in the tariff which he proposes.

Mr. CURRAN: I desire to state in regard to some of the remarks which have been made here, that I have been informed by several manufacturers that the statement, that we did not manufacture in Canada all the mining machinery required, is not correct. The manufacturers have assured me, and I have no doubt that they have also assured the Government, that they are perfectly able to manufacture in Montreal, and, I believe, in other large manufacturing centres as well, all kinds of machinery of whatever description it may be, which is required for mining purposes. In the meantime it is perfectly certain that the discussion of to-day must do good, if it does nothing else than to attract the attention of manufacturers to the statements made here, and induce them—if the distance be too far to transport the articles manufactured in either Quebec or Ontario—possibly to establish branches of their industries in that new province, where, if all that we have heard to-day be correct, there will be a very large field for them to reap a rich harvest in the manufacture of this mining machinery.

Mr. DAWSON: I would certainly favor the maintenance of the duty on such machinery as can be manufactured in this country, so as to prevent competition; but the fact is that in these new districts of Algoma and British Columbia (which must depend greatly on mining, and where there are new mines being discovered every day), it is very desirable that, until we can ourselves produce the machinery required in mining, it ought to a certain extent be admitted free of duty. There are certain

things, such as diamond drills, and complicated machinery like amalgamators, which are not produced in this country, and which cannot be produced profitably until the mining industry has been much more developed than it is at present. I would not wish that any machinery which can be manufactured in this country should be admitted free, but the Government should take this into their favorable consideration, and see if in some way the demands of certain sections of the country in this respect can be met.

Mr. JONES (Halifax): Perhaps no province in the Dominion is more interested in the mining industry than the province from which I come. Our vast coal fields and gold mining enterprises there, are even now of great value, and are increasing every year. I know it to be a source of complaint among those interested in that industry that they have been compelled to pay duty on a class of machinery which is not made in the Dominion. I remember when, a few years ago, the duty was first placed on coal by the present administration, one of the gentlemen of Halifax, who is supposed to represent the coal interests—who made it a question during the election, and had always advocated that a duty should be placed upon coal—was anything but satisfied when the regulation for the tariff on coal was presented to Parliament. That gentleman, who is recognised as an authority on the subject, said, that while the Government had imposed a duty on coal, they had taken away largely, if not entirely, the advantage which the miners would gain, by imposing heavy duties on machinery and other materials used in mining. The miners have always labored under the disadvantage of being compelled to pay heavy duty on what they required to develop their mines. The hon. member for Montreal centre (Mr. Curran) made the statement that all mining machinery could be manufactured in the Dominion, but that seems to be contradicted by other hon. gentlemen who spoke on the subject. Whether it is manufactured in the Dominion or not is of very little consequence. If it is made in the Dominion, of course it is only sold at the relative value which the machinery would cost, plus the duty if it were imported. There is, therefore, no advantage to the miners of the country that they can purchase machinery in the Dominion, because we know that manufacturers of machinery, like other manufacturers, fix their prices at what it will cost to lay down the foreign article plus the duty. I add my testimony to that of the hon. gentlemen who have spoken, that, in the interests of the coal and gold mining industries of Nova Scotia, it is of the highest importance that the miners should have free access to the markets of the world to purchase their machinery, and in which they can get the best articles at the lowest possible price.

Mr. MULOCK: The hon. member for Yale (Mr. Mara) has furnished us with some useful information as to the workings of this particular feature of the tariff, in regard to the great mining industries of the province from which he comes. We have expended many millions of public money to develop the resources of that province and to add to the material wealth of the whole of Canada, and to day the hon. gentleman has informed us, on the authority of a gentleman whose name he did not give, but whom I understand to be in political sympathy with the party to which he belongs, that the present tariff in its operation, locks up the mining wealth of British Columbia as effectively as nature has ever done. That statement, coming from the source it does, it cannot be said for a moment that the hon. gentleman or his witnesses are animated by anything but the best interests of the country in asking for relief from that state of things, and I cannot understand on what just grounds relief can be denied. Apart from the artificial obstructions offered by the tariff, there are sufficient obstacles presented by nature itself to the development of the mining resources of British Columbia, and certainly, until some change is made in the tariff, which is within the reach of the Government, we need not expect any return from the vast sums we have expended for the development of that province. Could a more forcible attack on the Government come from any source than that which has been disclosed by the correspondence of my hon. friend? He says those great gifts of nature, those great undeveloped laboratories in the bowels of the earth, are locked up and made useless to man, by reason not altogether of natural obstructions, but by reason of the artificial obstructions imposed by the administration and endorsed by the House, and, in a sense, by the country. Under these circumstances I think we are bound as a Parliament to give the fairest consideration to the proposition, and I think we can do so without impairing the general scheme which hon. gentlemen opposite have supported, and which they deem to call the National Policy. We can, without prejudice to that scheme, provide relief in the present instance. As hon. gentlemen have said, the tariff should not be available to handicap industries established in Canada, when Canada herself does not provide relief. Here we have the exact case to justify the suspension of the operation of the tariff in regard to this particular industry, at all events until manufacturers are found in this country ready to supply the needs of

the mining industry. Therefore, in order to meet the views presented by the hon. gentlemen who have spoken, while not jeopardising this great industry by giving occasion for the cry of the National Policy being in danger, I beg to move the following amendment, which, I think, leaves the National Policy in all its integrity, and is perhaps an argument in favor of its existence, at all events by admission, as it does not suggest an attack upon it:

That the motion be amended by inserting after the word "machinery" the words, "of kinds not manufactured in Canada."

Mr. CHARLTON: A year ago last summer as a member of the Ontario Mining Commission, I came in contact with a great many miners in various parts of the Province. The Commission visited all the mining regions of Ontario, and in the course of its investigations, took the evidence of 150 miners and persons connected with mining. Among other things which these miners declared desirable in their interests, for the purpose of securing greater development to the mineral resources of the country, was the introduction, free of duty, of machinery not manufactured in Canada, and the investigations made by the Commission on this point were of the closest and most convincing character. It was found that various kinds of machinery were not produced in Canada, such as for amalgamating work, stamps, diamond drills, &c. It is only reasonable to suppose that in the United States, where the mineral production amounts to \$560,000,000, compared with less than \$16,000,000 in Canada, the development in machinery and methods for producing ores has been much greater than it has been in Canada. Now this is a matter on which the miners undoubtedly are good judges as to their wants. We visited the copper region in Sudbury, the silver region west of Port Arthur, the mineral regions of all parts of Ontario, and there was no dissent among the miners anywhere as to the desirability of the introduction of mining machinery from the United States, not produced in Canada, free of duty. It was quite evident, from the results of our investigations, that the want of this has been one of the great bars to the development of our mineral resources. Canada unquestionably possesses mineral resources of great extent and importance, both in the precious metals and in copper, iron and the other metals. The mineral resources of Ontario are second to those of no region on this continent, although their development, and consequently their production, is very small, and anything that will tend to develop this industry will be in the general interests of this country. I hope the hon. Minister of Finance will take into account the vast importance of this almost undeveloped industry. Our own mineral resources are probably greater than theirs, except in coal, and the Government should seriously consider what steps may be taken to promote mining in Canada, and no step they could take will have a more direct beneficial effect than the one they are asked to take by the hon. member for North York. Nothing would be more likely to develop the vast mineral resources of Ontario and every section of the Dominion than the passage of this resolution.

Mr. COOK: It is very well known how rapidly the mineral resources of this country are being developed, particularly on the north shore of Georgian Bay, and the Prairie Sound and Algoma districts. There is understood to be nickel there sufficient to supply the world, and nickel is becoming a very important metal, as it can be alloyed with iron. But the proposal of the hon. member for North York does not meet the case. In the first place, if a party wishes to order machinery, such as is required for large establishments as they have at Sudbury, by ordering all that he requires in one or more establishments on the other side, he is placed in a more favorable position as regards prices than if he ordered part in Canada and part in the United States; and besides, in having a portion of the machinery made in Canada, and a portion in a foreign country, these two portions may not work satisfactorily together. For these considerations I shall vote against the amendment of the hon. member for North York, and for the original motion. I wish to do what is the best practical thing for the interests of this country, and if it is going to ruffle the feelings of any hon. gentleman on the other side or this, it is no matter to me. I do what I consider my duty to my constituents and to the country, and I shall, therefore, vote against the amendment of the hon. member for North York.

Mr. DAVIS (Alberta): Coming, as I do, from the eastern slope of the Rocky Mountains, representing a constituency 600 miles in extent, I shall support this resolution. I think we should be allowed to get all the mining machinery required into that country as cheaply as we can, so that we may get a population there which will make it really a country. Being handicapped by the long haul and the distance we have to take our goods through the mountains afterwards, I think we ought rather to be paid a bounty than to be asked to pay a duty on the machinery which comes into that country.

Mr. CASEY: I do not see any possible objection which protectionists can have to the amendment of my hon. friend from North York, (Mr. Mulock), seeing that it does not propose to interfere with any protection which is now, or which may hereafter be given to the manufac-

turers of mining machinery in Canada. If such machinery is to be taxed, then protection subsists in regard to it, and in regard to all other kinds of machinery; no harm is done by their free admission. I believe in encouraging the largest and most productive industries of the country, and the mines are worth vastly more to the country than all the manufacturers of mining machinery who exist now or ever could exist in Canada. The manufacture of mining machinery is only a means to carry on the mines, and I do not consider it is fair to carry on a national protective policy in such a way as to encourage the means at the expense of the object. A national protective policy should encourage the industry of the country, and the only way in which the mining machinery industry can benefit the country is to benefit the mines. Notwithstanding the existence of manufacturers in Hamilton or elsewhere, I intend to vote for the motion of my hon. friend from Prince Edward (Mr. Platt). The object of every patriotic policy must be to obtain the greatest good for the greatest number; to follow a course which will add to our wealth and standing, and will give employment to the greatest amount of labor.

Mr. MARA: As to the amendment and the motion as they now stand, I put it to my hon. friend from Prince Edward (Mr. Platt) whether it would be to the interest of the miner, or of the mining industry, that the motion should be pressed to a vote to-day. If it were, it might be defeated, and that would mean that the hands of the Government would be strengthened to allow matters to remain as they are. I am satisfied that my hon. friend does not wish that; neither do I; and I would suggest whether it is not well to withdraw the motion, or allow it to stand, or, I will propose that the debate be adjourned until such time as the Government make known to the House their proposed tariff changes. Then we can deal more easily with these matters than we can at present. If, however, the question is then pressed to a vote, I will be with the hon. gentleman. I, therefore, move in amendment to the amendment:

That the debate be adjourned until after the proposed tariff changes are laid before the House by the Government.

I will withdraw that if the hon. gentleman will withdraw his motion.

Hon. G. E. FOSTER: I desire to say a few words on this discussion, which has upon the whole been an interesting and a profitable one. A great many members comparatively have spoken in the course of this debate, and a great many opinions have been given from practical men and persons who are well acquainted with the districts from which they come in reference to the mining resources of different parts of our Dominion. I may say that that which was stated by my hon. friend from Cariboo (Mr. Barnard) is perfectly true. During the past year he has been constant, in season and out of season, in pressing this matter upon the attention of the Government; not only himself, but other members from British Columbia who have similar interests with him in this respect, have also made strong and vigorous recommendations to the Government to take off the duty on mining machinery. Persons interested in mining development in Ontario, in the Lake Superior region, and who are anxious to get in mining machinery, have also been pressing the Government to make some modification in the matter of admitting such machinery for the purpose of developing those mines. The same thing has taken place in various other portions of the country where mining development is comparatively new; the Government have not been idle in the matter, and I may say to the House that there is no one subject in connection with the tariff which has engaged more of our attention during the last few months than the question which is the subject of discussion to-day. But, of course, there are difficulties connected with it. There are three interests which ask to be considered. In the first place, there are those who are interested in putting in mining machinery for the development of new mines at the present time; they want a modification of the duties. There are those who have, under the National Policy, been investing their money and who have been engaged in developing mines in various sections of the country; and no person can take a comparative view of the state of the manufacturing industry ten years ago and its state to-day, without seeing the immense strides that our manufacturers have made in the way of producing machinery of almost every description and of excellent quality as well, to be used in mining industries. That matter has to be regarded, and it might well be considered by those who have invested their capital in that way, and who have arrived at a good degree of development in that industry, and were producing machinery of a very extensive character and of good quality, that it would not conduce to the permanency of the best interests of the country in that line, should we agree to the request of my hon. friend from Prince Edward (Mr. Platt), that all mining machinery should be allowed to come in free. His motion is very wide indeed. It would include everything, from the most complex and the largest kind of machinery, to the simplest forms of machinery, which are made in Canada just as well and just as cheaply as they can be made anywhere. Then there is another interest

to be considered, which is the interest of those miners who, during the last ten, fifteen or twenty years, have gone into mining ventures in this country, who have been at the cost of putting in machinery, having imported it and having paid the duty upon it. New machinery put into new mining industries would compete in a certain way with their own, and involve a competition which this interest look upon as being somewhat unfair to them. So that these three interests have all to be considered, and have been considered by the Government. Then, of those who ask for free mining machinery, there are three different classes. There is one class who want the duty taken off all mining machinery so that it may come in free. That class is represented by my hon. friend the mover of this motion, provided we take the motion as the index of his own views on that subject. I think that motion is wider than the sense of this House or the sense of the country, would approve of. There is another class who want only such machinery to come in free of duty as is not made in Canada. Now, any hon. gentleman who looks at the matter will understand the difficulty of coming to a conclusion as to what machinery can be made in the country and what cannot be made in the country, a much more difficult thing, perhaps, than to come to a conclusion as to what machinery is made in Canada and what is not made. Then there is another class who want mining machinery brought in free for a limited period, machinery of such a class as is not made in Canada. These are the three interests. I could not quite understand what was meant by the hon. member for Yale (Mr. Mara), when he stated that mining machinery could not be taken in there from the east; that an implement, for instance, from Montreal could not be taken into the Kootenay district, because it had to go through American territory, without paying double duty. I think that cannot be so, because we have, just as they have in the United States, arrangements for bonding by which, on their side, articles can be taken from the United States territory through Canadian territory into the United States again, and *vice versa*, without payment of duty. However, these are the conditions of the question. The Government have had them under serious and earnest consideration—we have them under consideration to-day. The duties which are involved, if they were to let mining machinery in free, would be considerable. Although it may be that the Government would have had a right to do that by Order in Council, the matter was so important that, suppose they had decided to take the duty off such machinery, it would scarcely have been wise to do so in view of the fact that Parliament was soon to meet, when the great interests involved in this matter could be taken up and considered by Parliament. It has been announced that the Government intend to make certain tariff changes, and I am in a position to state, as I have stated here, that we are considering this matter with a view to its best possible solution. Under the circumstances, it does not seem necessary to press the matter to a vote. I think my hon. friend who moved the resolution ought to take the assurance that I have given that the Government are carefully considering this matter, and to abide events, at least until the Government's opinion, after mature consideration, is laid before the House, when each hon. member will be at liberty to take such course as he sees fit.

Sir R. CARTWRIGHT: I believe my hon. friend from Prince Edward is moving entirely in the right direction, entirely in the interest of a deserving class in this community, and entirely in the interest of this country, in pressing that all this mining machinery should be admitted free. Further, I think that, as the Government ought to have made up their minds on this question—they have had plenty of time to do it—my hon. friend has nothing to gain by delay in pressing the House to a decision on this motion.

Sir D. A. SMITH: I am in favour of the most liberal protection being given to manufacturers in Canada, but I think this question is open to some exceptions, and this is one of those cases where an exception should be made; and I am, therefore, in favour of the motion of the hon. member for Prince Edward (Mr. Platt). At the same time, after the representation made by the Minister of Finance, I think it advisable that the amendment of the hon. member for Yale (Mr. Mara) should be adopted now, and I hope that the Government will give their consideration to this motion, and that, without further action on the part of any member of the House, they will be prepared to accede to this request. It is of the greatest importance possible that every encouragement should be given to the development of the industries, mining and otherwise, of British Columbia; and as the hon. member for Alberta (Mr. Davis) said, the expenses of transport are alone sufficient against that country. So that I certainly think the duties against all importations there, especially when the articles are for developing the great resources of that country, should be made as light as possible.

Mr. PLATT: Had the hon. the Minister of Finance requested the withdrawal of the motion, or that we

should grant an adjournment of the debate without further discussion, upon the ground that he was giving his best and most favourable consideration to the question under discussion, we might have been disposed to grant the request. But he preceded his requests by remarks which led me to believe that he is not at all prepared to accept the principle of the resolution. He has told us plainly that he believes the resolution which I have the honour to place before this House will not meet with the approbation of the House and the approbation of the country. If that be his opinion, I cannot reasonably expect that the principle will be embodied in the new Tariff Bill he proposes to bring down; and if he is not yet convinced that the people of the country are willing, for the purpose of encouraging the mining industry of Canada, to admit mining material free of duty for a limited period, if you like, or for any length of time that may be necessary, this House will be failing in its duty if it does not do its utmost to force its opinion upon the Government. The hon. gentleman tells us of various difficulties that stand in the way. We have heard of those difficulties before. They are difficulties which will meet any Government under the circumstances when they are nursing and cherishing what is known in this country as a protective or National Policy. It is part and parcel of that policy to throw difficulties in the way whenever such questions come before us. The manufacturers, who have had ten years of protection, the hon. gentleman tells us, have arrived at a certain degree of development and prosperity; and it was understood when the policy was adopted that after those industries became established, those other industries which were for the time suffering in consequence of the protection afforded those manufacturers, would in turn receive benefit, and those industries which had been able to get on their legs in this country, would no longer receive the benefit of a protective tariff. Now, mining is an old industry, but as regards its development in this country it is still an infant industry. Manufacturing industries, if they have arrived at the degree of prosperity which the hon. gentleman states they have reached, are no longer infant industries, and I hold that the mining interests of this country are such, that it is the duty of the Government, that those older industries so long supported by the policy of protection shall no longer stand in the way of the advancement of the mining industry. I maintain that the resolution I have submitted is one which will meet with the approbation of the country, because our people are becoming alive to the importance of the mining industry. We know that while in the past many mines in Ontario have remained undeveloped, new processes have been introduced which are likely to be brought into use in Ontario for the refining of the magnetic iron ores, the machinery for which will not be manufactured here for many years. We are aware that these new machines are just being manufactured in the United States and some other countries. Take, for instance, the appliances connected with the Edison process for separating magnetic iron ores, the new inventions for reducing copper and separating the nickel which exists so largely in the ore of the mines east of Prince Arthur, and we possess this class of mines which American capitalists are seeking to develop, and which American ingenuity and industry promise to render profitable. We know that for many, many years past, mines like Coehill and others of magnetic iron ore have remained white elephants on the hands of those who thought it was impossible to remove from the ores the sulphur they contain. Mr. Edison has discovered a method by which he is confident this can be done, and he has already purchased and selected a site in Trenton, and likewise sites in other places, for the erection of works into which he is willing to put his own money, and he has already made offers to different corporations as to what he is willing to do, and wherever his name is mentioned capital will flow into those enterprises. This is just the time for action, and there should not be a moment's delay in publishing what this country is willing to do on behalf of the mining industry, and the Government will not be justified in pursuing the course indicated by the Minister of Finance in yielding to those difficulties which he says are before his eyes at every turn, and in refusing that for which my motion asks. If the whole concession for which I ask cannot be granted, I hope the request embodied in the amendment will be granted; I will be willing to accept that rather than lose all. I suppose the motion for the adjournment of the debate will be carried. I think, however, as the discussion has aroused so much interest, and has been participated in by members on both sides of the House, I will scarcely be justified in taking the question out of the hands of the House, and I will leave it with the House to decide.

Mr. BARNARD: Considering the discussion which has arisen on the subject, it may not be amiss to refer to the fact that a year or two years ago the Government of British Columbia, in order to stimulate mining industries in the section which I represent, lately erected works intended as testing works in the district of Cariboo, at a cost of \$15,000 or \$16,000. The Government expended

that money itself to assist the mining industry in that district, and to promote the introduction of capital there. They made what I deem to have been a justifiable request on the Dominion Government, namely, that a rebate of duties should be allowed in that case. I believe the matter has not been settled yet, but that a discussion has arisen between the Provincial Government and the Dominion Government as to whether machinery of that class was or was not manufactured in Canada. Unfortunately, the whole works were burned down the other night, immediately after their completion, and I would suggest to the Government, if application is made for rebate of duty, as the Provincial Government propose to re-erect the works, it should be granted as applicable not only to the machinery in the works destroyed, but also to the new machinery.

Mr. BLAKE: I submit, Mr. Speaker, that this amendment is not in order. It is a motion to adjourn the debate, and is, therefore, a substantive motion and can not be an amendatory motion.

The Speaker: The motion is not a substantive motion; it is an amendment to the amendment, and, although improperly worded, it is in order as an amendment; but it ought to read: "That all the words in the main motion and in the amendment be struck out, and the following words substituted therefor." As an amendment I hold that it is in order, while if it were a substantive motion I should have to declare that it is out of order, since it specifies an undetermined time that the debate should be adjourned; instead of being put as all motions for adjournment, either of the debate or of the House, are, purely and simply, that the debate be adjourned now.

House divided on the amendment to the amendment, with the following result: Yeas, 109; Nays, 77.

Amendment to the amendment agreed to.

The question has thus been held over until the proposed Tariff changes are laid by the Government before the House.

Nova Scotia Gold Yield, 1889.

We are indebted to Mr. W. H. Brown, Accountant of Public Works and Mines, Halifax, for the following statement showing the quantity of quartz crushed and yield of gold by months for the year ended 31st December, 1889. Since these figures were compiled, one or two additional returns have been handed in, making the yield 250 ounces greater, or a total for the year of 26,155 $\frac{1}{2}$ ounces, and increasing the total value of the yield to \$496,950.40.

1889.	Quartz Crushed.	Yield of Gold.	Value.
	Tons.	Ozs. Dwts.	\$ c.
January	2,560	1,728 14	32,845 30
February	2,979	1,765 2	33,536 90
March	3,373	2,378 12	45,193 40
April	3,536	3,086 15	58,648 25
May	3,363	2,882 5	54,762 75
June	3,193	2,169 6	41,216 70
July	3,572	2,200 5	41,804 75
August	3,276	2,088 4	39,675 80
September	2,932	1,977 2	37,564 90
October	3,578	1,816 17	34,520 15
November	3,650	2,078 10	39,491 50
December	3,001	1,734 ..	32,946 00
Totals	39,013	25,905 12	\$492,206 40

RECAPITULATION.

Quartz crushed	39,013 tons.
Yield of gold	25,905 $\frac{1}{2}$ oz.
Value, at \$19	\$492,206.40.

The revenue received by the Department from Provincial mines shows a very satisfactory increase, being \$167,903.13 as against \$152,895.46 in 1888, or a total gain of \$15,007.67. The sources from which this substantial income was derived are as follows:

	1888.	1889.
Prospecting licenses	\$ 9,571 49	\$ 15,358 08
Rents (leases for gold) ..	4,720 50	6,055 00
Gold royalty	8,612 41	9,959 25
Licenses to search	3,940 00	5,260 00
Licenses to work and leases	1,275 00	2,875 00
Coal royalty	124,776 06	128,395 80
	\$152,895 46	\$167,903 13

Gold-Mining and Milling in Korea.

(By Willard Ide Pierce, New York.)

The native method of milling and mining gold-ores in Korea may not present any specially new features, but are chiefly interesting as primitive practices still followed at the present day.

In mining where the rock is hard, wood is piled up near the face of the tunnel or drift and then set on fire. The fire burns for twenty-four hours, after which, three or four days are given for the rocks to cool before the miners go in and extract the loosened material. The only tools in use are a hammer, a steel gad about five inches long, and a flat spoon-shaped basket. The pay-streak or chute is closely followed, and in place the workings are very small and intricate. Rock not yielding more than \$6 per ton is not extracted. The manner of opening a mine is to begin on the outcrop, where the rock pays, sink a shaft or run a tunnel on the vein, and follow the pay-streak and more easily worked ore. When this is exhausted, or the influx of water interferes, the opening is abandoned and operations are begun again at a new spot on the outcrop. The place usually selected is as high up on the mountain as possible, and in no instance is advantage taken of the topography by running a cross-tunnel to tap the vein.

The ore is brought in baskets to the surface, and there placed in sacks, holding about 150 lbs. each, and taken to be crushed. The rock is first crushed between two stones, as shown in Figure 1. The upper stone is oval



and rounded on the bottom, so that it can be readily rocked on the under stone. Two pieces of wood, used for handles are placed, one on each side, in grooves in the upper stone, and held in position by means of straw rope. The lower stone is not smooth on top, but exhibits three elevations running lengthwise, with shallow depressions between them. The middle elevation acts as a fulcrum on which the upper stone may be rocked. From two to ten men, according to the weight and size of the stone used, are employed in rocking. With four men, from 300 to 350 lbs. of rock can be crushed per day, the stone making 50 complete oscillations per minute. The men squat on each side of the stone and move it to and fro by means of the wooden handles. The ore is fed, in pieces up to the size of an egg or even larger, by one of the men. During the crushing one man on each side, as the stone rocks from him, uses a stick or scraper to stir the crushed rock. When the ore is fine enough, it is swept out on a piece of cloth, placed at one side of the stone, the rocking being continued all the time. After a certain amount has been crushed, it is usually put through a horse-hair sieve, and the coarser portion is treated again. An upper stone intended for four men, measured 23 inches in length, 20 inches in width at the base and 15 inches in height. Crushing is usually performed in sheds to prevent the wind from blowing any of the fine stuff away.

The crushed ore is taken to men who rub it between stones until it is very fine; the rubbing is generally done wet. The powered ore is received by other workmen, who pan it and save the free gold. The pan is of one piece of wood, 20 inches in diameter and 5 inches high; and the men who use this instrument are the most expert panners I have ever seen. The pan is not held in the hands, but floats on the surface of the water, one side only being raised or lowered to agitate the contents. As the pulp is very fine, and the gold in the same condition, the top of the water in the pan is frequently sprayed so as to settle any gold that may be floating. The first tailings are washed off directly from the right-hand side of the pan. After this the sulphurets and gold are collected on the right-hand side of the pan, and the tailings on top of the sulphurets are, by a few skilful movements, washed over to the left-hand side. The pan is then half revolved and the tailings are washed off from the right-hand side. The same operation is repeated after the tailings have all been removed, with the sulphurets and gold, the former being saved and again rubbed. No quicksilver is used; but I do not think that there is any loss in free gold.

*Washington meeting, American Institute of Mining Engineers.

The Canadian Mining Review

CONDUCTED BY . . . B. T. A. BELL.

OFFICES:

UNION CHAMBERS, 14 METCALFE ST.,
OTTAWA.

Vol. IX. APRIL, 1890. No. 4.

Our Gold Fields In Quebec.

In view of the increased interest which has of late been manifested in the mineral resources of the Province of Quebec, not only as regards the comparatively new mineral asbestos, in the production of which Canada may now be said to lead the world, but also in the development of large and new bodies of copper ore, the great value of which as a source of supply for acid is just beginning to be fully realized, it is a matter for enquiry why the gold fields of the Province, concerning which so much has in former years been recorded, should have failed to attract the attention which they so evidently deserve. For that in the Province of Quebec there exists a very large extent of territory containing rich deposits of gold, not only in the alluvions of its ancient river channels, but in many of the quartz veins which traverse the slates and sandstones of the Chaudiere and Ditton Districts, and of the whole belt of similar rocks which extend along the eastern portion of the Province contiguous to the boundary of New Hampshire and a portion of Maine, has been very conclusively established. One has but to take up the papers written on this subject by the late Mr. James Douglas of Quebec, or to glance over the earlier reports of the Geological Survey, more especially those from 1847 to 1866, to see that, in this area, the chances for profitable gold mining, under suitable Government regulations and proper management, are unsurpassed by any other portion of the Dominion, and possibly even by the adjoining States.

The evidence also presented before the Select Committee appointed by the Quebec Government in 1865 to consider the question of the Chaudiere gold field, while containing doubtless some statements bordering on the sensational, and therefore requiring to be cautiously accepted, present such a mass of cumulative evidence, both on the part of skilled workmen in this field, as well as from ordinary explorers, that we can but come to the conclusion that had such stories of the presence of gold in large quantity proceeded from any other section of the country than the Province of Quebec, the influx of gold miners and of capital would have almost equalled that of the palmy days of the Californian discovery.

The evidence presented in the different reports of the Geological Survey is also largely confirmatory of that stated by other writers on the subject; and yet, in the face of all evidence tending to prove the existence of a gold field equally adapted for quartz mining, as shown by repeated assays from a number of leads, with

that of Nova Scotia, and far surpassing that country in the value of its alluvial workings, a feature in gold mining which has in Nova Scotia apparently never awakened any interest, we find not more than three or four companies, almost without capital, trying in a very small way and with the worst appliances and the almost entire lack of proper mining skill, to extract the gold from the ancient river channels, whose presence and great richness have been known for twenty years, but which, except in two or three widely separated cases, have never been explored to any extent.

The history of gold mining in the Province of Quebec has apparently from the very start been a huge system of blunders, and possibly the greatest, as it was the first, consisted in giving the entire control of all the gold found in the seignior of Rigaud, Vaudreuil, on the Chaudiere River, and in which the richest developments yet found are located, into the hands of one person or family *forever*, and without any provision being made for the payment of royalty to the Government, since the clause inserted in the letters patent, and intended to cover this point, was so worded that it practically became inoperative; the royalty only being payable on such gold as was obtained by smelting the ore—a mode of working gold which has never prevailed in this country in gold mining, and which most surely never will. By the *forever* clause in the lease the outside public are entirely debarred by the Government from taking any part in mining or exploration in this section of the province, except by permission of the owners of the seignior. But this is in turn prohibited, since in 1864 the De Lery Company, who derived their patent direct from Government, sub-let their entire mining right to the De Lery Gold Mining Company for a term of thirty years, so that until the second ownership expires no work can be done in the seignior by outside parties without direct permit from the second company. The effect of all this is very evident. While the company is apparently quite willing to grant mining leases to any person desirous of working gold mining claims in any part of their territory, there is a very well founded objection on the part of those contemplating investment in this direction to advance the capital necessary for the erection of permanent works on the large scale by which the extraction of the gold can be most profitably carried on, owing to the insecurity of tenure existing under the present regulations. Works adapted to the requirements of the case mean the construction of reservoirs for permanent storage of water to meet the possible requirements of a dry season, extensive flumes or ditches for the conveying of such water when required, properly prepared grounds and appliances for washing the gravel and collecting the gold when separated; in fact a somewhat extensive plant. This, with a prospect that in a very few years their lease must of necessity expire, and if good results are obtained, an

almost absolute certainty of non-renewal from the original company on any terms which would permit of profitable mining, has effectually placed a bar to all possible chances of development in this direction. Here, then, is one of the principal causes why capital does not at present flow into the Chaudiere district, rich as it is in gold.

As regards the second gold mining area, which, according to the most reliable reports, is in many respects equally as valuable as the Chaudiere, though not nearly so extensive, we find that, in a lucky moment for the proprietor, but an unlucky one for the Government of Quebec, the whole right and title to some 6,000 acres of the country, including mineral rights as well, has also passed *forever* into the hands of a private individual, and is, if anything, even more securely locked up in so far as the investment of capital is concerned, than the other.

The history of gold mining in Quebec, from the first discovery, sixty years ago, furnishes reading, not only of great interest, but of a kind from which good sound practical lessons may be derived. The first vein of gold found in 1836 was valued at from \$50 to \$60; a very fair sized nugget for any country, and sufficiently large, one would suppose, to warrant anyone interested in gold mining to make further and vigorous search; yet for nearly fifteen years but little attention seems to have been paid to it, further than in the securing in 1846, by the De Lery family, of the mining rights already referred to. From 1850 to 1860 desultory mining operations were carried on at a number of points by various parties. Some exceedingly rich pockets were found on the Des Plantes and the Gilbert, as well as on the main Chaudiere River, while a series of trials at the forks of the DuLoup in 1851-52, extending over one acre of gravel from the bank of the stream with ordinary appliances only, showed a margin of profit sufficient to warrant anyone in investing the capital necessary to make a speedy and abundant fortune should the proper appliances be used. The amount of the gold obtained from this acre of gravel was considerably over \$4,000—the profit considerably over \$1,000. The results of these trials are given in the report of the Geological Survey for those years, and being official may be taken as reliable. Yet, owing to some dispute with the proprietor of a neighbouring lot, the work which promised so well had to be abandoned, and nothing further was done in this quarter for nearly thirty years. It is unfortunate that the next attempt to extract the gold from the gravels of the DuLoup in 1879-80 should not have been undertaken by some one with even a slight pretence to mining knowledge so that the most fitting plan for successfully carrying on the washing of the gravels, and what is equally important the collecting of the gold afterward might have been adopted, but instead we find a very large amount of money, aggregating many

thousands of dollars, placed in the hands of a person who certainly, from his previous occupation, could not be supposed to have acquired much practical or scientific knowledge of the best means to be employed in the extracting of the gold. A trench eleven miles in length was dug along the banks of the river DuLoup for conveying water for the hydraulic process, and a magnificent head of about 150 feet was obtained, sufficient to tear down the gravel banks at any desired rate, but very slight provision appears to have been made for collecting the gold, either coarse or fine, after the bank was torn down; though from the trials made in 1852 it is known that there was sufficient in every cubic yard to have paid most handsome dividends, even by the old rocker method of washing. Under such management it can scarcely be a matter of wonder that the costly experiment was a failure of the worst kind.

A second attempt to work an old channel near the village of St. George was equally disastrous to those engaged, though the outlay was on a greatly reduced scale, the management being the same. Four shafts were here attempted before bed rock could be reached, the operations extending over a period of several years, the last and final attempt requiring nearly twelve months to sink 165 feet. This surely implies engineering skill of a wonderful kind.

In the work on the Gilbert, where exceedingly rich ground was found in 1863-64, the mining also was of the crudest kind. The claims allotted were very small, water could not be obtained for washing the gravel properly, and there appear to have been no proper appliances for saving the fine gold. A sluice 1,800 feet long, built at a cost of about twelve thousand dollars, to bring water from the upper part of the stream, which had been dammed for that purpose, was destroyed before it could be utilized, simply through lack of proper precautions in its construction; yet here, in the face of all these adverse circumstances, gold was obtained in large quantities, so that four men, working under the greatest disadvantages, are said to have taken out nearly \$80,000 in less than four years. Anyone visiting the workings as conducted at the present day must wonder how any gold except the coarsest can be saved at all. Sluices of very slight pitch and of insufficient length, are unfitted with any proper means for saving the fine gold, the greater part of which must of necessity be carried away down the stream with tailings. The only mining skill observed is on the part of those who have used the pick and shovel in some former enterprise in the vicinity, and yet, gold in good paying quantities continues to be obtained, simply because much of the gold in the district is coarse, and nuggets of ten to one hundred dollars are not uncommon, while others having a weight of nearly sixty ounces have been obtained.

Such coarse gold does not travel far, yet no practical attempt to test the quartz leads by milling has ever been made, except by one ill-starred crusher so faulty in construction that when free gold was put in none ever could be extracted. Yet, in spite of all these well known facts, when the value and importance of the gold fields of Eastern Quebec are mentioned most people calmly shrug their shoulders and smile incredulously. Why? Because most people are content to take the results, or rather the lack of results due to stupid blundering and ignorance of the first principles of mining, properly so called, as a satisfactory and conclusive test of the true value of the entire district.

There is no doubt, as can be proved by the evidence furnished both from official reports and from other sources, that in nearly, if not in every stream, tributary to the Chaudiere above St. Joseph, gold can be obtained in paying quantities with material of the right sort and knowledge of the conditions involved.

The gold mining of to-day should be understood far better than that of twenty years ago. In the Nova Scotia gold fields the mistake of sinking shafts in unprofitable lodes is not now made so frequently as in the first days of the industry in that Province, simply because certain laws apparently exist which govern the distribution of the metal. Scientific skill is now producing profitable returns where twenty years ago bad management and utter ignorance on the part of those in charge of valuable mines squandered capital by the hundreds of thousands of dollars. The crude style of gold mining has also surely lasted a sufficiently long time in Quebec. But until some provision is made on the part of the local government by which the titles so long ago obtained can be extinguished and these areas thrown open to the advent of outside capital, there does not appear to be much chance of permanent improvement in this direction. Should the government of Quebec acquire once more the titles to the mining rights of the province in gold, and proclaim the districts of the Chaudiere and the Ditton mining districts, with proper regulations as to title, size of claim, royalty, etc., there is not the slightest doubt that capital, to almost any desired amount, would pour in for the development of this great industry. In the present condition of mining in Quebec, with its great deposits of apatite, copper, asbestos, iron, gold and silver, one would suppose the establishment of a well organized mining bureau would be a prime necessity, not only conferring great benefit upon the province at large but bringing in also a very considerable direct revenue to the government. The little Province of Nova Scotia has long felt the benefit arising from such a bureau, and certainly, with proper management, Quebec, with her far greater variety and abundance of mineral wealth and her immensely greater area, would derive not only equal but far greater

results from the establishment of such a department. The mining industries of Quebec are but in their infancy. No one can say to what enormous proportions they may in the next twenty years extend. Foreign capital is awaiting investment to-day in many lines, but is restrained from entering, in some cases by the unfavourable conditions which are known to prevail. Surely the time is not far distant when these conditions will be changed, and when the gold mines of Ditton and the Chaudiere, freed from the incubus that has so long stifled their development, will be teeming with a mining population whose labours will be properly directed and whose rewards will be sure. May the happy time come right speedily.

A New Superphosphate Company.

From an interview with Mr. R. N. Hall, M.P., we learn that his recent trip to London was successful in securing the organization of a company with a substantial financial support for the manufacture, on a large scale, of artificial fertilizers for the Canadian and American markets. The scheme involves the purchase of the property of one of the most prominent phosphate companies in the Buckingham District, and a long term contract for the supply of sulphuric acid from the Capelton Works, near Sherbrooke. It is intended to erect large superphosphate factories both at Buckingham and at Capelton.

Mr. Hall reports an increased interest in the London market for developed phosphate properties, and much enquiry about asbestos. The great obstacle in securing capital for the development of both these industries is the enormous speculative prices placed by proprietors and agents upon properties controlled by them.

When it is considered what an extensive area is represented by phosphate indications, and the thousands of such properties which are offered and pressed upon the London market, the folly of such a course must be apparent.

When prices have come down to a basis which leaves some chance for the employment of capital in *bona fide* working we shall see prosperous activity in our phosphate districts. The present speculative mania does no good to those who are responsible for it, and only hinders the development of a legitimate industry. The keen competition for the English and Continental markets between the phosphate supplies of Norway, South Carolina and Canada, with certain recognized disadvantages pertaining to the latter in the way of transportation and difficulty of treating the rock, should convince speculators that it is only upon the basis of moderate prices that the working of our phosphate areas stands any reasonable chance of success.

A new company, styled the Nova Scotia Syndicate, limited, was registered in London on the 25th ult., with a capital of £12,000, in £5 shares, to acquire and work mineral properties, and particularly the Waverley Mine, upon terms of an agreement with C. G. Palgrave.

Our Portrait Gallery.

[A series of portraits and biographical sketches of Canadian mining engineers, mine managers, inspectors, geologists, explorers, etc.]

No. 1.

Mr. E. Gilpin, Jr., Deputy Commissioner and Inspector of the Nova Scotia Mines.

In commencing a series of sketches of representative mining men, difficulties necessarily present themselves in making a selection of a subject for the first; but Nova Scotia has been, and is so pre-eminently to the forefront in mineral development that we have no diffidence in giving as our initial portrait the "counterfeit presentment" of one of her sons, whose name and personality are alike familiar and prominently associated with the industry, and who has, in a very conspicuous manner, contributed much to the material welfare of her various mining interests.

Mr. E. Gilpin, jr., Deputy Commissioner of Public Works and Mines, and Chief Inspector of the Mines of Nova Scotia, was born in the city of Halifax, N.S., in the year 1850. His father was the Very Reverend Dean Gilpin; his mother Amelia McKay, daughter of the late Mr. Justice Haliburton ("Sam Slick"). Mr. Gilpin was educated at the Halifax Grammar School, and thereafter at King's College, Windsor, where he graduated in 1871 as B.A. with "optime" in chemistry, and honours in geology and mineralogy; also Welsford, General Williams and Alumni prizeman. At Windsor he had the advantage of pursuing his chemical and mineralogical studies under the late Dr. How, well known as one of the best analysts of the day. These studies were continued afterwards under Professor Lawson, at Dalhousie College, whenever the pursuit of his profession gave opportunity. After leaving college he began the practical study of Mining Engineering, especially at the Albion collieries of the General Mining Association in Pictou county, and the knowledge and experience gained in this way was materially extended and improved by a visit to the principal mining localities in England.

In 1873, he was elected a member of the Nova Scotia Institute of Science, and in 1874, a member of the Geological Society of London. After visiting professionally all the mining points in the Lower Provinces and Newfoundland, he was for two years engaged in the exploration of the iron ore deposits of Pictou County, succeeding Sir William Dawson, who had devoted much time to the problems presented by the unequalled grouping of many iron ores of various geological ages in a comparatively small district.

During the existence of the Halifax Technological Institute he was appointed Lecturer on Mining, but did not lecture, as the Institute was not able to secure sufficient support to

guarantee complete courses. The success attending the drawing and mechanical engineering classes, however, laid the foundation of the present Art School of Halifax.

In 1879 Mr. Gilpin was appointed by the Government of Nova Scotia its Inspector of Mines. In September, 1881, he was appointed a member of the Board of Examiners of Colliery Officials, to which Board he has continued to act as Secretary up to the present time. The visit of a portion of the British Association to Nova Scotia, was under his charge, in so far as related to the mineral sections of the Province. He also read two papers on Nova Scotia Gold and Coal before that Association. Mr. Gilpin also acted as local secretary during the memor-



E. Gilpin

able visit of the American Institute of Mining Engineers to Nova Scotia, and was entrusted with the carrying out of the various excursions, etc., which resulted in one of the most successful and enjoyable meetings held by that body. At this meeting he was elected a member, and contributed an excellent paper descriptive of the Nova Scotia gold fields.

In October, 1886, upon the decease of the then Deputy, Mr. Gilpin was appointed to the position of Deputy Commissioner of Public Works and Mines conjointly with his position as Inspector, and these positions he still holds in conjunction with an appointment made some years previous as Provincial Analyst.

Upon the formation of the Royal Society of

Canada he was appointed one of the original fellows.

Following the formation of a Board of Examiners for granting certificates to Underground Managers and Overseers of Coal Mines, the Government has established schools of instruction for candidates desirous of undergoing examination, at various points in the coal districts. In these schools, ten in number, are taught mine surveying, mining practice, etc., to an extent corresponding to the positions to be filled by those passing the examinations.

These schools are under the supervision of the Inspector of Mines, who, it must be confessed, is not allowed by the Government to rust for want of work. Amid the various details of inspection, of the instructors' schools, and the various calls of the Public Works Department of even a small province like Nova Scotia, Mr. Gilpin has still found time to write many papers on Nova Scotia mines and minerals for home and foreign societies. In 1883 a large edition of his report on the Nova Scotia minerals was circulated by the Government, a new edition of which is much needed. His annual report on the mining industries of the province gives full details of the progress of the development of this resource, whose importance may be seen when it is stated that the revenue from Mines Royalties is now \$165,000 a year, nearly double what it was a few years ago.

The Transactions of the North of England Institute of Mining Engineers, the Geological Society of London, the Nova Scotia Institute of Science, the Royal Society of Canada, and the American Institute of Mining Engineers contain numerous papers by him, among which may be mentioned: "The Carboniferous of Western Newfoundland," "The Coal Measures of Newfoundland," "Limonite Ores of Pictou Co.," "Nova Scotia Copper Ores," "Pictou Coal Field" (several papers), "Submarine Coal of Cape Breton," "Iron Ores of Nova Scotia," "Pit Waters," "Gypsum of Nova Scotia," "Canadian Coals," "Trap Minerals," "Geology of Cape Breton" (several papers), "Gold Fields of Nova Scotia," "Folding of the Carboniferous in the Maritime Provinces," "Manganese Ores of Nova Scotia," "Limestones of Pictou Co.," "Notes on Nova Scotia Gold Bearing Veins," with other papers of more technical and local character, principally contributed to the transactions of the Nova Scotia Institute of Science, etc. Many of these papers contain analyses by the writer, notably those on the iron ores and pit waters. The paper on Canadian coals gives the fullest set of analyses of Nova Scotian ores ever made, being the result of a special investigation into their qualities made by him for a foreign syndicate. This paper was read before the North of England Mining Institute, and awarded by them with a special present of mining books.

The paper on the Limestones of Pictou County, read before the Royal Society, gave his analyses of numerous beds of this mineral, and while showing the suitability of certain beds for iron making, incidentally touched upon their freedom from magnesia, a point of interest from their connection with marls and gypsums.

The Canadian Institute of Civil Engineers embraces most of the mining engineers of the Dominion, and Mr Gilpin has assisted to further their aims in the Lower Provinces. Has served as a member of Council; and its Transactions contain an elaborate paper by him on coal mining in Nova Scotia, giving in detail the systems of working, hoisting, pumping, etc.

Mr. Gilpin was married in 1875 to Florence Ellen, daughter of Lewis Johnstone, Surgeon, Albion Mines, and has three children.

Of untiring industry and unequalled integrity and honor, an ardent lover of geologic science, a trained and competent engineer, Mr. Gilpin combines in ample measure those sterling qualities which contribute so largely to the material well-being and prosperity of the mining community in which he takes so conspicuous a place.

The subject of our next sketch will be Mr. H. S. Poole, General Manager of the Acadia Coal Company at Stellarton, Nova Scotia.

Au Revoir.

During the last few days the Geological Survey has suffered a severe loss in the resignation of Dr. A. C. Lawson, one of its most efficient officers, who has gone to Vancouver to begin independent work as consulting geologist and mining engineer.

Dr. Lawson is a gold medalist in Natural Sciences of Toronto University, and a Doctor of Philosophy of John Hopkins University in Baltimore, and in 1882 accompanied Dr. Bell across the plains of the North West in his expedition to the Athabasca river.

Since that time he has been engaged in unravelling the geology of the Archæan plexus on Rainy river and the Lake of the Woods, and the results of his labours are published in the Annual Reports of the Geological Survey for 1885 and 1887-8, while another report on an adjoining area is shortly to appear.

In the summer of 1888 he attended the meeting of the Universal Geological Congress held in London, England, at which the origin of the Archæan gneisses and schists was one of the principal objects discussed, and his able paper there, read before the geologists collected together from all quarters of the globe, proving the intrusive character of many of the basal Archæan gneisses, placed him at once in the first rank among the scientific men of the day. He is also the author of many other papers and memoirs, all giving evidence of close observation, extensive research and deep thought.

Being an expert mineralogist, and an easy and accurate writer, he is eminently fitted to assist in developing the great natural mineral

resources with which British Columbia is so richly endowed, and his sterling integrity and independence will soon recommend him to all with whom he may be brought in contact.

Dr. Lawson carries west with him the best wishes of a large circle of friends and admirers, not only in Ottawa, but throughout America and Europe.

The Mineral Production of Nova Scotia in 1889.

The Annual Report of the Commissioner of Public Works and Mines is to hand, and, as usual, contains a mass of information respecting the provincial mines of great interest and value to the general public. From the returns furnished to the Department, we find that there is an increase in the yield of eight, and a decrease in the production of nine of the minerals recorded in the report for 1889. Of gold there has been a yield of 26,155 ounces as against 22,407 in 1888, or an increase of 3,748 ounces; iron ore, 45,907 tons compared with 41,611 tons in 1888, an increase of 4,296 tons; manganese 67 tons as against 88 tons in 1888, decrease 21 tons; coal raised, 1,756,279 tons against 1,776,128 tons, decrease 19,849 tons; coke made 35,565 tons, as against 29,808 tons, increase 5,757 tons; gypsum exported 147,344 tons, against 125,800 tons, an increase of 21,544 tons; grindstones 18,000 tons, against 17,225 tons in 1888, increase 775 tons; antimony 55 tons, as against 308 tons, decrease 253 tons; limestone 19,000 tons, against 15,448 tons, increase 3,552 tons; and an increase in the production of copper ore to the extent of 500 tons.

Wire Ropes.

In concluding an excellent paper read before the South Wales Institute of Engineers, Mr. T. H. Deakin said:—It would appear that the wire required to make a good rope must combine strength and toughness; but no hard-and-fast rule can be laid down as to the make of ropes for indiscriminate use, and I find the better plan in asking quotations for ropes is to give the makers the exact conditions under which the ropes will have to work—whether in a downcast or furnace-shaft; whether the pit is a wet one; size and form of drum, and the pit-head pulley, the load, and the speed at which it is lifted. A respectable firm will then, for its own reputation's sake, give the benefit of its experience, and suggest a make likely to yield the best results under the special circumstances of working. Some years ago I took charge of a colliery where it had been customary to use 4 in. circular iron wire ropes working off an 8 ft. diameter drum. The average life of the three last ropes used was, in the upcast shaft, six months eighteen days, and in the downcast eight months sixteen days respectively. We adopted two three fourths in. circular improved plough steel wire ropes in lieu of the larger iron ones, and the average life of the three succeeding ropes has been for the upcast fourteen months six days, and for the downcast twenty-five months fourteen days; the cost at to-day's prices of the iron ropes being 3s. 5'60d. per fathom, and of the plough steel ropes 4s. 11'75d. But the steel ropes lasting more than two and a half times the life of the iron ropes, made the comparison in cost in favour of the plough steel ropes, as say 5s. is to 9s. 1d. There were also other advantages in using the plough steel ropes: (1) They gave one-eleventh greater breaking strain; (2) the engines had less than half the weight of rope at the "lift;" (3) when taken off the shaft they could be used for haulage purposes, whereas the large iron ropes were done with. It was therefore clear that the wrong make of rope had been used on so small a drum. Speaking generally, it may be taken that after providing ample strength, then the lighter the rope the

better. This is sometimes objected to because small wires are ordinarily used in the smaller ropes, and there is therefore less wear in them; but this need not be. I remember a case of a long underground incline where the gradient was so little that the empty tubs would scarcely take down the rope, and where, on this account, it was necessary to have as light a rope as possible. It was also necessary to have a medium-sized wire, for the road was a wet and dirty one, causing a good deal of rubbing. For this work a rope was made of four strands, thus allowing of a fairly large wire to be used in a small rope. I would not, however, recommend using ropes of this make, except under some such circumstances as the above, for with four strands the rope is not as uniform in shape, nor can it be as easily or firmly spliced, as when made in the ordinary way. Ropes are made either flat or round, and these are again divided into "ordinary make," such as those first in use, or "compound" ropes. An "ordinary" made rope is understood to be a six-strand rope with six wires in each strand. A "compound" is made with wire cores in the strands, such as a six-strand rope, with eight or more wires outside and a wire strand for core. For winding purposes, if the ropes are made of the old construction, a rope six strands of nineteen wires will be found to give good results. If the rope is made "Lang's lay," fewer and larger wires may be used, and ropes six strands of seven, eight or nine wires with wire cores do excellent work. When wire cores are used they should be made of annealed wire, so as to allow for the stretching of the strands when under load.

LETTERS TO THE EDITOR.

Phosphate Analysis.

TORONTO, April 17th, 1890.

The Editor:

SIR,—With reference to the vexed question of phosphate analysis, and different results obtained by buyers' and sellers' chemists respectively, the solution of the trouble is not a difficult one. I would suggest the appointment of a Government Inspector and Analyst, say at Montreal, whose duty it would be to grade all phosphate that is offered in the market; and all contracts to be made on the basis of his report and certificate. This would be the most satisfactory way of selling for the Canadian miner and equally fair to the broker.

There is a Government Inspector at the port of Montreal to grade wood ashes, and why a similar officer has never been appointed to guard the interests of the phosphate trade—of vastly greater importance than that of wood ash—is a mystery. United action on the part of mine owners would rectify this neglect in a very short time.

A. S. THOMPSON, M.D.

MONTREAL, April 18th, 1890.

The Editor:

SIR,—I have read Dr. Francis Wyatt's "intemperate and illconsidered denunciation" in the March REVIEW with considerable amusement. Dr. Wyatt is evidently very angry because Capt. Adams and I have dared to speak disparagingly of Maret's method for the estimation of phosphoric acid; and because I explained that it had been almost universally superseded by the Molybdate method. Dr. Wyatt presents a selection of figures from his laboratory note book, remarking "the figures speak for themselves." What do they say? What bearing has this selection on the question whether the Maret or Molybdate method is the one generally used by chemists in estimating phosphoric acid? One is forcibly reminded of the three tailors of Tooley Street, who began their petition, "We, the people of England!"

If Dr. Wyatt objects to what I have written concerning the widely extended use of the Molybdate method let him lay aside rhodomontade, let him ascertain what method is adopted by leading English, German and American chemists; let him disprove my statements if he can.

J. T. DONALD.

Mr. J. Lanson Wills, who left for London in the beginning of the year, is now en route to report on certain petroleum sources in Trinidad, Venezuela, and Ecuador, (S. A.), where he will in all probability be located for the next three months. Mr. Wills writes that when he left London the Phosphate Trust was fairly in the way of becoming serious and practicable, "but when it would be in activity and life was uncertain."

PHOSPHATE.

In General.

Mr. E. D. Ingall, with Mr. James White and party, will shortly resume their work on behalf of the Geological Survey in the phosphate region of Ottawa County. Last season, the geological work was found to concentrate itself chiefly on the broad and extended belt upon which are the considerable excavations of the Crown Hill, High Rock and Star Hill mines, time being also found to similarly investigate for some distance the belt on which are the openings of the North Star mine and adjacent properties, at which latter point, the belt being narrow and the bush and surface cover having been more thoroughly removed by clearance and bush fires, better facilities were afforded than elsewhere for acquiring the necessary data. "In this way," writes Mr. Ingall, "it is hoped to obtain a few thoroughly worked-out examples, which may serve as illustrations of the numerous similar belts in the surrounding country, and of their nature, associations and habits, thus possibly adding something to our stock of knowledge of the pyroxene belts and the associated apatite deposits. Such systematized knowledge, systematically applied, must necessarily be the basis of all intelligent mining ventures."

Freights.

Every preparation is being made for the resumption of ocean shipments, the port of Montreal at date of writing being entirely clear of ice, and the river, further down, fairly open. Our quotations for ocean freights are: Liverpool and Glasgow—Regular liners, 6/3; outside steamers, 5/-. Business is being done at these figures, although several outside steamers have been booked at 7/-. London—By regular liners, 10/-; no outside tonnage has yet been offered. Hamburg—Business is being done at 15/- over the season.

Markets.

Business has been done for German account at 1/4½ on 80% with rise. English manufacturers have not as yet paid this price. The lower grades are keenly feeling the competition of the Osso phosphates. English prices for phosphate may be quoted at 1/- for 70% and 1/3½ and 1/4 for 80%, with 1/5 per unit rise. The market is a little less firm owing to the expectation of a supply of Florida phosphates from the newly discovered beds, but much uncertainty exists as to the early availability of these deposits, and as to their average quality.

Templeton District.

At the McLaurin, work has begun on three different shanties; about 75 men will be employed here from this out.

The Blackburn mines, operated by the East Templeton District Mining Syndicate (Limited), are turning out a large quantity of ore.

Lievres District.

Mr. Walter Pickford, who has returned from his visit across the water looking hale and hearty, reports that mining operations at High Rock will be pushed with the utmost vigor. A new Ingersoll 5-drill compressor, additional boilers, and other plant is being added, and we may look for a substantial increase in the production from the pits of this company. A little over 3,000 tons will be ready for shipment by opening of navigation.

The pits of the Canadian Phosphate Co., although still troubled with water, are yielding excellent outputs.

Mr. S. P. Franchot, of the Emerald, arrived home from the other side on the 17th inst.

There will be sold at the office of Registrar for the County of Ottawa at Hull, on 27th May next, by order of the Sheriff, the phosphate lands owned by "La Société Française de Phosphate du Canada." The properties comprise:—In the township of Portland East: Lot thirteen (13) in the first range; west half of lot two (2) and north half of lot three (3) in the second range; west half of lot two (2) and north half of lot three (3) in fourth range; lots eight, nine, twenty-two and twenty-four (8, 9, 22, 24) in the sixth range; lots seven, eight, nine, ten and twenty-one (7, 8, 9, 10, 21) in the seventh range; lots six, nine, ten, eleven sixteen, seventeen and thirty (6, 9, 10, 11, 16, 17, 30) in the eighth range; lots four, five, nine, eighteen, nineteen, twenty, thirty, thirty-one (4, 5, 18, 19, 20, 30, 31) in the ninth range; and the mining rights existing on lots one and two (1, 2) in the third range, the south half of lot one (1) in the fourth range; on lots three, seven and ten (3, 7, 10) and north part (39 acres) of lot one (1) in the sixth range; on lots twenty-

seven and twenty-eight (27, 28) in the seventh range; on lot twelve (12) in the eighth range; on lot seventeen (17) and the south part (75 acres) of lot sixteen (16) in the ninth range. In the township of Portland West: Lot twenty (20) in the fourth range, and the mining rights on lot three (3) in the tenth range.

It is reported on very good authority that Mr. George Stewart, now in London, has been successful in placing the Brazeau property, in conjunction with his lots at the High Falls, at a good figure, and that arrangements are being made on this side for an early commencement of work.

Kingston District.

Mr. Adolph Lomer, of Montreal, has acquired from the Anglo-Canadian Phosphate Co. the Bob's Lake mines in Bedford, Ont. A steam tug has already been transported to Bob's Lake; and a barge is in process of construction. This fine property will thus be made readily accessible in summer as well as in winter, and it is intended to put a strong force immediately at work to produce phosphate.

Mr. Lomer has also arranged with the Anglo-Canadian Phosphate Co. to work their Battle Lake mines in Templeton, P.Q., upon royalty.

The Anglo-Canadian Phosphate Co. has discontinued contract mining at the Otty Lake mines in North Burgess, Ont., and has resumed the system of days' work under the charge of Mr. Robert Cordick. They have been so fortunate as to strike several new veins at the outset of the renewed efforts, one of which shows a width of over ten feet of solid phosphate and others have a continuous breadth of three or four feet. Over three hundred pits have already been opened on this property, and it seems that the surface workings are still in good supply.

The Foxton mine is turning out phosphate in large quantities, and will employ about 50 men during the season. The shafts are being worked with steam drills day and night and a third shaft is being sunk.

MINING NOTES.

Nova Scotia.

Miscellaneous.

The next regular meeting of the Gold Miners' Association of Nova Scotia will be held at the Halifax Hotel on Tuesday, 6th of May, at three o'clock in the afternoon. At this meeting will be presented the report of a special committee appointed at the April meeting to devise ways and means for utilizing the Association, and the recommendation of this committee will be brought before the meeting for immediate action. It is understood that the report will deal with the re-organization of the Association in a radical and very important manner.

The output of Limonite ore from the mines of the New Glasgow Coal, Iron and Rail Co. at Springville is estimated to have been about 3,000 tons.

From Londonderry, the returns show 40,823 tons extracted.

Gold Mining Supplies.

The principal depot in Nova Scotia, carrying the most complete assortment of first class goods, is

H. H. FULLER & CO'S,
41 to 45 Upper Water St., Halifax, N.S.

Our line comprises Explosives, Fuse, American and English Mill and Hammer Steel, Bar and Bolt Iron, Steel Wire Hoisting Rope, Hemp and Manilla Rope, Rubber and Leather Belting, Miners' Candles, Oils and Lamps, Miners' Tools, Machinists' Tools, Blacksmiths' Tools, and every requisite for the gold miner.

H. H. FULLER & CO.,
Halifax, N.S.

At Brookfield, Colchester, about 1,700 tons were mined for use at Londonderry. The vein was found too narrow going east, but going west it was proved to have a thickness of at least 30 feet.

The Eastern Development Co. at Colchester are building a railway and smelters. The county of Cape Breton has released the company from taxation on all real and personal property for 25 years. Below ground the shaft has been deepened about 50 feet, and more cross-cuts driven, which have proved the continuation in depth and quality of valuable veins. The ore extracted in the underground levels has been dressed, and the quantity now in stock is about 2,000 tons.

During the past summer two companies began to work the iron ores of the East River of Pictou. One of these, under the management of Mr. H. V. Leslie, of New York, has begun the construction of a railway from Sunnysbrae to New Glasgow, which is projected to extend to the harbour of Liscomb, on the Atlantic coast. The second company, under the management of Mr. Graham Fraser, of New Glasgow, has also surveyed a line of railway from the iron mines of the I. C. R., near the fork of the East River, and vigorously pushed the development of the mining areas. The mining has been done on a large vein of excellent limonite, which follows the contact of Silurian and Cambro-silurian rocks with carboniferous limestone in the valley of East River.

Fifteen Mile Stream.

The Egerton Co. under the new management is pushing work. The new compound condensing engine, tandem type, built by I. Matheson & Co., of New Glasgow, is on the ground ready for erection, and extensive alterations in the surface are under weigh. Mr. Jas. A. Fraser, M.P.P., is the managing director of the new company.

Killag District.

Mr. Geo. Stuart has gotten out his supply of cordwood for the ensuing year and this month commenced active operations. The new lode discovered late last fall will be developed this summer. The paragraph on this district in the Mines Office report for 1889 (just issued) would lead to the supposition that a mill had been built last year; such is not the case, as the property has had a very good mill, equipped with the Nissen batteries, for several years.

Lochaber District.

Reports from this district are most discouraging, it being evident that the ores, whether assaying well or not, are free from milling. The management of the property is in good hands, but is handicapped by the character of the deposit.

Beaver Dam District.

Mr. Turnbull and associates have gotten out the timber for a new mill of the Homestake type, to replace the old Yeadon mill. It is understood that the order for the machinery has been placed, and that the work of erection will begin this month.

Salmon River District.

The lode in this famous mine has pinched somewhat, but has been enriched in consequence, the returns for March showing 173½ ounces from a little over 400 tons, or an average yield of about 8½ dwts. per ton. The Mines Office report for 1889 is also in error as regards this district when it states that the plant is giving satisfaction; on the contrary, the mill is to be remodelled, as are also some parts of the mining plant. It is understood that the services of Mr. Wm. MacPherson, the veteran millwright, have been secured.

Whiteburn District.

So far this year this district has produced only 93 ounces, coming from the Graves mine. The new management here is busy in getting the property into working shape, and is changing over from underhand to overhand stoping as fast as possible.

Goldenville.

Mr. Robt. McNaughton has discontinued work in this district, and at present has a small force working on the middle lode at Wine Harbour.

Stormont.

On Thursday, the 31st of March, work upon the Palgrave Co.'s property on Hurricane Island, was closed down indefinitely. On Friday morning at 9.30, under the personal direction of Mr. H. K. Fisher, the president of the company, the work of removing the entire surface plant was commenced, and by 7 p.m. that day the entire pumping and hoisting plant, with all the buildings, had been removed. On Saturday, the old mining leases were surrendered and new ones obtained, and before midnight that day Mr. Fisher had effected services of arbitration notices on a majority of the parties claiming surface rights on the island.

This action was the result of a prolonged litigation as to the ownership of the surface rights, etc., and is, we

Believe, the quickest piece of dismantling work on record in Nova Scotia.

The company have a fine property here, and will rebuild a very superior plant just as soon as the question of damages can be settled.

Pictou County.

At No. 1 and 2 Slopes of the Intercolonial Coal Co., work has been for some time attended with some degree of danger, owing to a "creep" which seemed to imperil the safety of some portions of the mine. "I am of opinion that the danger of that is past, as no indication of any serious nature has been seen for the past few months in the year, and a large percentage of coal is now being successfully won. The air is kept well up to the workmen, of which a very large volume circulates in this mine."

Work has not been carried on to any large extent at the Scott pit. During the latter portion of the year twelve men were started to work with a view to pierce through a fault in the east side, and there test the quality of the coal. This was done, and the coal proved satisfactory, the fault being an upthrow of some 16 or 18 feet. Since that time no work has been done.

The Acadia Slope (Acadia Coal Co., limited) is now down a distance of 3,560 feet, a new lift having been sunk this summer of 440 feet. A considerable quantity of gas is met with in this lift, but every precaution, as hitherto, is taken to guard against every possible accident. No powder is used in the new lift or in any portion of the mine. A new overcast airway, as well as air returns, are completed, and a steady flow of air circulates freely round the different portions of the mine. The air and regulations were all that could be desired.

The McGregor pit has been kept steadily to work all the year, and the workings extended to the deep. The North Slant, which is down now a distance of 2,760 feet at the top dip at an angle of 16°, and at the bottom 25°. Pillar working, which in all mines is attended with danger to the immediate workmen, has been prosecuted successfully, and a very satisfactory percentage of coal is being had.

The English Slope (Cape Pit Seam, Stellarton) is down about 1,700 feet. During the latter part of the year some gas has been met, and, in consequence, safety lamps are used. In the distance gone down two-fourths have been encountered in the coal measures.

At the Foord Pit, after much perseverance and difficulties, they have succeeded in clearing the bottom of the Square Pit, and their large pump is now in effective condition. Very serious obstacles have been met and overcome in doing this much, and we trust that ere long this fine mine will again be in working order.

At the Vale colliery, Thorburn, improvements have been made during the year in the air passages by making connections between 1,600 feet level and 1,800 feet level, thus decreasing the distance air has to travel, and consequently increasing the air current around working faces.

Mr. Madden describes the operations at the Black Diamond as follows:—"In January they began drawing the pillars to the rise, and extending the bords westerly to the dip, and subsequently began drawing the pillars in the lower lift. At present it is all pillar work, which is being done very well. The tunnel mentioned in last report driven to test underlying seam was driven about 120 feet, when they struck some heavy feeders of water, they then stopped driving and put up a wooden dam three feet thick to prevent the water escaping into the workings, as they connect with the Acadia mine and were causing them trouble and expense to keep the water out. The wooden dam proved too weak to sustain the pressure, which is calculated to be about 300 lbs. to the square inch. A brick dam 2 ft. thick with 16 inch of a curve was subsequently built and likewise proved too weak. A third dam is now under course of construction; it is built in two sections. The inside section is 16 inches thick from pavement to 3 feet high, thence 12 inches thick to roof 5 feet; a space of three feet is left when the outside section is built three feet thick. Clay is rammed in the space between the sections."

Cumberland County.

We are indebted to the Annual Report of the Commissioner of Mines for the following extracts referring to the operations of the various collieries during last year:

The production of the Springhill Mines was 425,149 tons. The fire in the Syndicate Slope was successfully extinguished by damming water up against it. It is proposed to utilise it for the present as an up-cast and travelling road. The New or No. 5 Slope shows the turn of

the measures toward Amherst. It is now down about 1,200 feet, and the levels going north show coal of good quality. It is reported that not far from the north-west corner of the old General Mining Association's area, a coal outcrop has been found. If it dips toward Springhill it will complete the structure of a basin. If the dip should be northward, the Springhill Basin is either complete or the northwardly dip of the crop would show that there is in Springhill a basin subsidiary to the great basin of the coal-field. As these mines give off more gas than in former years, the management are introducing safety-lamps at several points.

The sales to the Province of Quebec from this county were 177,461 tons, compared with 182,927 tons during the year 1888.

In April, at the Joggins, they began sinking a new lift in the slope, and also drove a place to surface from the top-lift for an airway. They are now down a distance of 600 feet, and have levels driven in some distance, and a back balance completed. In extending levels on 1,500 feet lift they crossed three dikes or troubles in the coal measures, two down—throws and one up—throw. The coal is now pretty well extracted from the old lift, and owing to so many faults on the 1,500 feet lift, the output of coal has been retarded. The work is now in fair order, and we may reasonably anticipate the output to be materially increased next season.

The management of the Chignecto Colliery have driven a plane from the present lower lift out to the surface on the east side of the mine, inside the old original fire, and are using it as a return airway and travelling slope, and during the latter portion of the year have begun operating on the east side of the mine. Some small fires during the year have originated from spontaneous combustion, but have been all built off and appear to have died out. They have been extracting pillars, but the angle or dip of the coal being so steep makes it a rather difficult job in this mine. Ventilation has been always satisfactory.

Mr. Hall, who for 16 years has successfully managed the Springhill collieries, Nova Scotia, has resigned. Under his careful management these collieries have been well developed. It is understood that he will still reside in Springhill.

Cape Breton.

The total sales in 1889, as per Mr. Neville's official report, were 751,997 tons, against 738,250 tons in 1888, and 715,442 tons in 1887.

The home sales were 700,182 tons, compared with 190,508 tons in 1888.

The sales to Quebec were 381,074 tons, against 381,012 in the year previous.

At the Sydney mines the management are fitting up a new underground forcing pump of 36 in. cylinder and 5 ft. stroke to force the water from pit bottom in one lift of 700 feet to the surface, and thus take the place of the large Cornish set of pumps. A stone engine house with arched brick roof is being built at the pit bottom for this pump. On surface, tressel work is built to the outer side of the coal yard, and an apparatus put up by which the tubs of coal for banking are drawn out to the bank by an engine. A screen is erected for screening the coal on the outer side of the heap, and a branch railroad to this screen from the main line.

At Victoria mines work was brisk during the whole of the season. West levels were extended 550 yards, and the east levels, 450 yards. East slope has been straightened and graded. The length of the slopes at present from the surface to the low levels is about 1200 feet. A new Blake pump has been placed at the bottom of the lower lift, which discharges to the upper pump and lodgment. Its dimensions are as follows: cylinder 15 inch, 12 inch stroke, 6 inch plunger, calculated to throw 130 gallons per minute. A new trolley has been made and placed on the slopes for the men to ride on, ten at a time. The management say they intend to put another on, so there will be one for each slope. The screens and bank have been roofed and covered in.

At the Reserve mines the east slope has been driven three hundred and ninety-six feet down, and levels turned off. North level driven six hundred feet, south level driven five hundred feet. In the main or west slope fifteen rooms were worked, some of them driven to the barrier. Six pairs of men to the rise of this were kept splitting and drawing pillars. The old furnace has been pulled down and a new one built in place of it, which is

about six inches wider and higher than the old one. The management say that it is their intention this winter to drive the east slope down six hundred feet further in order to gain another lift.

The coal at the Intercolonial seems much improved, being more free from impurities and the seam thicker. In order to test the Ross seam under this area, a slope has been driven into the crop of it about one hundred feet. The coal is five feet seven inches thick, and appears to be a good quality.

There has not been much change in the workings at Little Glace Bay, except that the levels on the north side have been driven about five hundred feet into the Campbell area, which they now control. Also, the level on the south side of the pit has been driven five hundred feet. On surface, a new locomotive shed has been built, and the railroad wide-gauged from pit to wharf. New four and a half ton cars built and put on the track instead of the pit tubs. The bank and screens have been roofed and covered in. A new shed for a saw-mill has been built, and a steam saw-mill placed therein.

At the Caledonia, work has gone on as usual both at the dip and rise; dip levels have been extended on the east and south side, and rooms worked off; a few pillars have been split and drawn from the south side of the rise workings. On surface, a new No. 3 Manville windmill and Starr pump has been placed over a well twenty chains north from pit, which supplies the reservoir with water and gives good satisfaction.

The main dips of the Gowrie mines have been driven down 750 feet, which now makes them, 1,800 from shaft level; from that point levels are turned off east and driven 900 feet. Also the west levels from the upper dip have been driven 300 feet, which makes it about 1,800 from the landing. A pair of slants is being driven from the level to come out on the west level near the pit bottom. The coal from the west side is to be drawn up this slant this season; a new pump has been placed at the bottom of the low lift, which delivers water from there to the lodgement and pumps of No. 1 deep.

New Brunswick.

"Peat bogs are numerous and well developed near the bay of Fundy coast and in many places inland. Those near Musquash, Popelogan and Digdeguash Rivers are quite extensive. Lying just east of Musquash Harbor is a bog covering an area of 450 acres and 20 feet in depth, which is now about to be utilized in the preparation of "moss litter." This in an article used in stables as bedding for horses. Owners of studs in the United States have for some time been looking for a material for this purpose sufficiently light and porous to be an absorbent of the liquids, moisture and ammonia which collect in stables, and which could afterwards be used as a fertilizer in gardens, &c. A few capitalists from St. John, St. Stephen and other places have formed what is known as the Musquash Moss Litter Company, and having purchased this bog, are now erecting buildings and machinery there for the preparation of this article, which, it is claimed, is well adapted for the object intended, and as good as the imported European moss litter. The kind of peat used is not the upper or living peat, nor the deep-lying, decayed material, but that between the two, in which the mosses and rootlets are only partially decomposed, and which has the fibres nearly whole. The chief process in its preparation is depriving it of the water, of which it contains 90 to 95 per cent. This is done by a plunger, by pressing it between rollers and by evaporation. When thoroughly dried it is packed in bales for shipment, and is worth \$15 to \$17 per ton in the principal United States cities. This new enterprise promises to be successful. This paragraph has been gleaned from Mr. Chalmers Report to the Department of Interior."

The same gentleman writes as follows regarding the Brine Springs and Salt deposits found at Sussex: "Brine springs are found at Sussex, at Salina, on Salt Springs Creek, and at Bennett's Brook, near Peticodiac. Five or six hundred bushels of salt per annum are manufactured at Sussex. This is all consumed locally, and used chiefly for table and dairy purposes. Several springs occur near the site of these salt works. A boring 125 feet deep was recently sunk at one of these springs—13 feet of it through surface deposits and 112 feet in rock. The object was to find the salt rock, but nothing of the kind was met with. The strength of the brine, I was informed, increased slightly till the solid rock was reached; beyond that it did not perceptibly change. At Salina an attempt was made some years ago to manufacture salt from the brine of the surface springs there, but was discontinued. Possibly a series of borings might result in improving the quality of the brine, but none have yet been made. At Bennett's Brook nothing has been done to utilize the springs there, to my knowledge. In all these places the

brine contains a considerable percentage of sulphate of lime or gypsum. There appears to be less, however, in that of the Sussex springs than at Salina or Bennett's Brook. The salt manufactured at the Sussex works is said to be of a superior quality."

Quebec.

Our latest advices from the asbestos districts show that unusual activity is prevalent at all the mines of Thetford and Black Lake. The raw material continues in strong demand, and supplies are insufficient to meet the wants and uses of consumers. Consequently a considerable advance on our last quotations has to be reported, one large producer having predicted that the prices for crude No. 1 will go as high as \$250 per ton before the season closes. It would appear by this that the foreign trade is prepared to absorb the whole of our asbestos production at profitable rates. Additional and improved machinery, and largely increased working forces are notable at most of the mines, and with favourable weather there should be a large advance in the year's production.

There are four copper pyrites mines in this district actually in working operation now, viz., the mine of G. H. Nichols & Co., of New York, the Eustis mine at Capelon, and the Moulton Hill and Howard mines.

The Nichols and Eustis mines have been producing for a term of years; they produce a grade of pyrites which burns freely, and is well adapted for the manufacture of sulphuric acid.

The Moulton Hill and Howard mines have been opened up within the last year, and the work has been mainly development.

At the Howard mine, shafts have been sunk, and drifts and cross-cuts made to a depth of some two hundred feet, and a large amount of ore opened out, which will be broken when the developments are sufficiently advanced.

At the Moulton Hill mine about the same amount of work has been done, and in addition a plant has been erected, calculated for raising, dressing and shipping from 100 to 200 tons of ore daily. The ore-ground is as yet broken except incidentally in the shafts and drifts. The shipments of the company to date from ore incidentally met with amount to some 2,000 tons.

Ontario.

The Bill respecting mining regulations and also that amending the General Mining Act have both passed their third reading. A third Bill respecting mining claims, (having relation to staking off mining claims,) was withdrawn after its second reading, as it is desired to make it more extensive, and to embrace matters not now included in its present shape. It is desired, also, to have the benefit of the report of the Mining Commission before dealing with that subject.

We learn from Dr. Bell, one of the Commissioners, that the Report of the Royal Mining Commission will not be issued for at least two weeks yet. Surely, after so much tinkering, we may expect something good and to the point. Let us hope so.

Mr. H. P. Brumell, of the Geological Survey spent a portion of last season in a visit to the counties of Welland, Lambton and Essex, in all of which drilling is being actively carried on. In his preliminary report he describes these workings as follows:—

In Welland county a company has been in operation since the month of June last, and had, at the time of my visit, completed one well, which attained a depth of 846 feet, and had begun a second. From the first well a flow of gas of \$1,000,000 cubic feet had been obtained, though subsequent to my visit this well was shot, and the flow increased to about 1,750,000 cubic feet. An accurate log and specimens were obtained of this well, and also of others in the Niagara Peninsula. In August last eight wells had been completed in the Peninsula. Of these, three are at Port Colborne, two at Niagara Falls South, and one each at Thorold, and at St. Catharines and in the township of Bertie. A very small flow of gas was obtained in the well at St. Catharines and at Thorold, while from the wells of Port Colborne there is a total production of about 50,000 cubic feet per diem. It is understood that the burningspring at Niagara Falls is being supplied with gas from one of the wells recently sunk at that place.

At Bertie and Port Colborne the gas was obtained from the upper beds of the Medina formation, which is reached at these places at a depth of 735 feet respectively. At Niagara Falls the gas comes from a depth of 201 feet, at which depth the bore is in the lower beds of the Niagara shales, while at Thorold and St. Catharines the

flow is obtained from the lower part of the Trenton series, in the former place at a depth of 2,394 feet or 489 feet in the Trenton limestone, and at the latter in a sandstone at a depth of 2,185 feet, or 13 feet below the limestones of the Trenton series.

Two more wells have been drilled in the townships of Bertie and Humberstone, to a depth of 851 and 836 feet respectively, having a flow of gas of about 500,000 cubic feet per diem each, the flow in both cases being from the Medina sandstone.

In Lambton county the oil fields of Enniskillen township are still being extensively drilled upon. A number of drillers living in Petrolia and Oil Springs were interviewed, and logs and information regarding wells throughout the province were obtained from them.

In Essex county exploration for gas is being continued, It has, however, been obtained in quantity but in one well, namely, "Coste No. 1," which has a daily flow of 10,000,000 cubic feet. This well, drilled to a depth of 1,031 feet, is situated in the township of Gosfield, lot 1, concession 3, eastern division. Wells had recently been completed at and near Kingsville and at Comber, and drilling was, in September, being carried on at Amherstburg, Essex Centre, Marshfield, Kingsville, Leamington and Blytheswood. The well at Marshfield, being sunk for Messrs. Walker & Sons, of Walkerville, will be watched with considerable interest, as it is the intention of the firm to carry this drilling down as far as the Trenton limestone.

Sudbury District.

By recent changes in the United States Tariff Bill, nickel ore is admitted free into that country. This will please Mr. C. J. Ritchie and his Ohio stockholders in the Canadian Copper Co. as well as the other concerns now operating the copper and nickel mines in this promising district.

Messrs. H. H. Vivian & Co., Swansea and Birmingham, England, who are operating here, are seeking Incorporation.

On the 4th inst., while a car load of rock was being hauled to the surface in one of the pits of the Canadian Copper Company, the cable snapped, precipitating the car with great violence to the bottom of the shaft and instantly killing three miners at work there. Accidents due to carelessness and negligence are far too frequent in some of our mines, and call urgently for an efficient service of Government mine inspection.

The Ontario Government has granted \$1,000 to build a road to the north of Sudbury six miles, to reach the Dominion and Stobie mines, \$1,500 to extend the road west to a French settlement at Chelmsford, and \$1,000 to open a road from Whitefish Station seven miles to the timber limits on Lake Penago.

At the mines of the Canadian Copper Company mining development continues brisk. The Stobie track is now clear, and operations at this mine will be resumed at once on a large scale. The ore from this place is largely used as a flux for smelting.

At the Evans mine this company is putting in a new 10 drill Rand air compressor to replace the 6-drill Ingersoll. The new boarding houses at this mine are now fully occupied; they are well laid out, commodious and comfortable. The rock-house—one of the best in Canada—was brought from the Calumet and Hecla mines. The output runs from 90 to 100 tons per day, and average from 8 to 10% copper and from 3 to 4% nickle. It is first brought to rock-house, where it is crushed and sorted, then dumped into bins and taken to the roast-yard at smelter and roasted.

At Copper Cliff the ore in 5th level west continues rich and in large quantities, it being estimated that quite 3,000 tons of 12% Cu. and Ni. ore are in sight in this new level. A new compressor will shortly be added to the plant at this well equipped mine.

At the suggestion of Capt. Jones the diamond drill was set to work at a point about half a mile from this mine, and the results of the operations have been extremely favourable, proving beyond doubt that the virgin ground contains even richer deposits of nickel than that now operated. The new find has been named the "Great Jones Mine," after Captain Jones. The drill is still boring.

Both smelters have been shut down for a week in order to admit connections of blast pipes to one engine, thereby

saving fuel and use of extra engine. At date of writing the company has just shipped 6 cars of matte in bulk to Joseph Wharton, of Philadelphia, the large nickel refiner.

Mr. Duncan McIntyre and a number of gentlemen connected with the Dominion Company visited their mines and works during the month, and expressed their approbation of the progress of operations there. The management are carrying in their coke by rail, and will soon be ready to commence smelting.

The Murray mine (H. H. Vivian & Co., Swansea) is making slow but steady progress in development.

Rat Portage District.

The building of the new reduction works at Rat Portage proceeds apace, and the engines are now being placed in position. A number of American capitalists are in the district with a view to securing claims.

Port Arthur District.

The action of the Ontario Government in placing the sale of mining lands in the hands of the local agents will be a great boon to the investors and explorers, who will now be able, on arrival here, to learn exactly what lands have been taken up and what lands are available for entry, and be able to conclude on the spot all transactions necessary to secure a title.

The Torrens title system, we understand, has also been amended so as to accommodate the requirements of our mining districts.

The railway into the mining region is getting well into shape, so that in a few weeks trains will be running from Port Arthur direct to the famous Beaver and Badger mines, and by 1st October to Silver Mountain. Everything is being done to expedite matters as the waggon roads are at present well nigh impassable.

The rush of prospectors has begun unusually early this spring, many having already gone out, although the snow is still deep in places. The iron fields are at present attracting the most attention, and commencement of work on the branch line of the C. P. R. to the Atikokan iron range will doubtless create a rush into that valuable gold and iron section.

The Badger mine is working an increased force and continues shipping high grade ore. Better results will doubtless follow the improvement of the stamp mill, and the operations of the air compressors are now being arranged for. Drifting is being carried on westward on the lower level, and is now in 300 feet in the shaft. The vein increased from 4 feet at the shaft to 7 feet at the drift, and is carrying good pay ore, composed of blende, argentite and native silver. As soon as the compressed air plant is installed, the working force will be largely increased. At present seventy men are employed.

On 9th inst. a deputation consisting of Messrs S. J. Dawson, M.P. Conmee, M.P.P. Senator Clemow and others waited upon Sir John Macdonand, and urged a grant to aid in the extension of the last 15 miles of the P. A. D. & W. Ry. Sir John promised to give the matter careful consideration. As soon as it is absolutely known that aid has been granted by the Dominion Government for this much needed branch, work will commence on at least six of the different gold lodes in that section of country.

Capt. Hooper, of the Beaver mine, is making preparations for stoping out the 20,000 tons of ore now in sight. The engineers are pushing the repairs to the mill, and expect to have everything in readiness to start it up by the 15th of April. Its capacity is ten head of stamps, and will be doubled about the 1st of May, and if the developments turn out as they are expected to at the North Bluff vein its capacity will be trebled. The increased amount of water necessary for its increased capacity will be brought by syphon from a lake on North Bluff as soon as the mill starts. The force of miners will be largely increased, and there are facilities for hoisting 30 tons of ore per hour. The shipments during last month are expected to realize \$20,000.

The Shuniah Weachu Mining Co. held its annual meeting last February, and the report shows a more prosperous condition of affairs than in 1888. Shipping of rich ore still continues, and the dumps are accumulating an enormous quantity of mill rock.

The West End Co., although in very rich ore, are working only a small force, which they are arranging to increase so soon as the roads improve or the welcome whistle of the railway engine is heard.

The Elgin mine still continues in rich ore, and is steadily advancing in favor.

The Crown Point mine is making good progress, and the ore continues to improve.

The Silver Glance and Mink Mountain mines are reported to have been lately bonded to Belgian and American syndicates for large sums.

The Star, Stirling, Black Hawk, Medicine Bluff, Lone Pine, Y4, are all being developed, and although only in their infancy are attracting considerable attention—showing up well in silver.

The Murilla mine pumps being unable to overcome the rush of water, the mine has been temporarily closed down.

The copper deposits in Blake Township so ably referred to by Dr. Lawson, late of the Geological Survey, in the *American Geologist* for March last, are showing up better as developments proceed.

Several bids have been received by parties holding mine properties, and the Black Bay lead and silver deposits will this spring be actively worked.

The following are the Custom House returns of silver exports from Port Arthur for quarter ended 31st March, 1890:—

1890.	SILVER ORE.		Total.
January.....	27 tons	\$18,050	\$18,050
February.....	1 "	1,525	1,525
March.....	.....	100	100
So far as rep't d			
Total.....	28 "	.....	\$19,675

North-West Territories.

From returns received by the Dominion Lands Agent's, the number of applications for Coal Lands during the year 1889 was 125, and 26 of the applicants were given the privilege of purchasing, within a specified time, the location for which they applied, and 43 of the applicants were given permission to prospect thereon. Only two of them bought the land applied for, or a portion thereof, and 4 of the applicants being homesteaders were permitted to mine coal by paying 5 per cent. royalty on coal mined.

The revenue for the year derived from the sale of coal lands was \$1,662.50, being \$73,037.50 less than the previous year. The total area of coal lands sold up to date is 12,261.63 acres, and the total amount received therefor \$126,171.32.

Ten leases for twenty-one years were issued in 1882 and 1883, of land within the Souris Coal District, but as the lessees had not complied with the provisions thereof these leases have been cancelled.

By an Order in Council dated the 11th of July, 1888, the regulations for the disposal of coal lands in the Province of Manitoba and the North-West Territories were made to govern the disposal of Dominion coal lands in the Railways Belt in British Columbia.

By Order in Council dated the 17th September last, several amendments have been made to the coal mining regulations, and provision has been made for the disposal of coal and other minerals under lands patented, the mining rights of which have been reserved. By the same Order in Council, all patents from the Crown for lands in Manitoba and the North-West Territories shall reserve all mines and minerals which may be found to exist within, upon or under such lands, together with full power to work the same. This is an extension of the Order in Council of the 31st of October, 1887, which made the same provision with respect to lands in Manitoba and the North-West Territories situated west of the Third Meridian.

Returns from the Dominion Lands Agents show that during the past year 41 entries were made for mining locations other than coal. The revenue from mining lands other than coal for the year was \$184,15, received in

payment for fees for entry, and for registration of assignments. The total area of mining locations sold up to date is 108,086 acres, which realized \$5,406.50.

No amendments have been made to the regulations since October, 1887, with the exception that the regulations do not now govern the disposition of gold and silver under Dominion lands in the Province of British Columbia.

The North Western Coal and Navigation Company at Lethbridge has very considerably extended its operations by completing the shaft for hoisting, and making new galleries, levels or drifts, further switches, &c., so that although the output for the past twelve months may not have increased very considerably over the year preceding, the company is now in a position to increase its output to probably 1,000 tons per diem, and in a short time to double that quantity should the demand increase to that extent. It is anticipated that there will be during next season railway connection to the south, giving access to the reduction works at Great Falls, Helena, Butte and Anaconda in Montana, which will afford this company a large and profitable market for its coal.

Mining at Anthracite point has not until recently been pushed with the energy with which it was formerly conducted, the hesitation being caused by negotiations which have been going on with a view to disposing of this property to a strong English company. These negotiations have not yet been completed, and the present owners have for the past three months been pushing as vigorously as possible new slopes and galleries, so that in a year the output can be worked up to 1,000 tons a day if necessary. In doing this the output of the mine has been greatly reduced temporarily, but in the near future it can be increased. The present proprietors have unlimited faith in this property, and even should the negotiations referred to fail, there is no doubt that capital will be forthcoming to work the mine, and, in about one year, to quadruple its previous output. During the past season three new seams have been discovered at Anthracite, two of which, so far as one can judge from their present openings, are from five to seven feet in thickness and of first class quality. The third would appear to be thinner and possibly not of so good quality, but it has not been opened sufficiently for a correct idea to be formed.

At Stair, near Medicine Hat, two companies are in existence. The old mine at Stair, originally known as the Woodworth, subsequently the Stair coal mine, has, within the past few months, passed into new hands, and mining and shipping coal has been in progress to some extent. Opposite this mine, on the south bank of the river (South Saskatchewan), a company, known as the Medicine Hat Coal Mining Company, has certain land on which, during the past season, a shaft was sunk to enable mining operations to be carried on. No mining of any appreciable extent has, however, been done, nor can it be done with profit till a branch line of railway, some six miles in length, is constructed, connecting this point with Medicine Hat. The construction of this switch or branch the company states, will in the near future be proceeded with.

The development or output at the Cochrane mines here formerly owned by Messrs. Chaffey and Vaughan and also by Mr. T. B. Cochrane, has in the case of the former been nil, in that of the latter not appreciable. A company has been floated in England with, it is reported, a capital of about half a million dollars to purchase and develop the properties of the latter gentleman at Cochrane, which, besides mining property, represent also some lumbering interests. This company has now a mining engineer from England making examinations as to the most economical means of development, and also respecting the establishment of coking furnaces, it being anticipated that next season will see a demand for coke for smelters to the west.

Considerable development has taken place near Canmore during the past season, and the number of seams which have been brought to light and their dimensions border on the marvellous. One cannot realize it without a personal inspection, and if late reports are reliable, the area of the coal basin in the Bow River, west of the gap, is very much greater than was heretofore supposed. The output has not been extensive; but sufficient explorations have been made to enable the proprietors to acquire a correct estimate of the quality, of the enormous quantity, and also of how to open out the works to the best advantage.

There has been considerable local excitement manifested on the east slope of the Rocky Mountains, north of the

49th parallel, respecting the discovery of petroleum; but development will be required to enable one to estimate the value of the discovery. In this connection it is worthy of consideration whether it is not advisable in the public interest that petroleum lands should be treated in the same way as coal lands: that is, sold outright at a fixed price per acre. The ordinary regulations requiring on each claim development equalling \$5 per acre per annum does not meet the case. To put down a test hole means an expenditure of several thousand dollars; anything less would be a mere waste of labor and money, and no one will go to that outlay unless a considerable area be secured.

At two points on the Canadian Pacific Railway line, viz., Langevin and Cassils, gas wells have been in existence for nearly six years; the flow has not preceptibly diminished though the wells were piped for water not gas. The probabilities are that if thorough tests were made, combined with correct piping, it would be found that gas exists in sufficient quantity for fuel and lighting purpose. The impetus which the establishment of this fact would give to the progress of the district would be great.

The contract for sinking the new shaft of the North-West Coal Co., at Lethbridge has been awarded to Messrs H. and A. Kerr at \$47.50 per yard. The site for this shaft is situated about three-quarters of a mile north of the station, and the shaft will be sunk three feet below the coal, about 300 feet altogether. The new air shaft is going ahead well. It is down now over 60 feet, and the windlass has been replaced by a gin worked by horsepower. Two more shafts are to be sunk, one an air shaft, almost immediately.

The Line of Railway to connect the Medicine Hat Coal Co. Mines to the Canadian Pacific Railway will be begun at once.

"Owing to the heavier fall of snow this winter, says the Edmonton Bulletin," it is not likely that the opportunities for mining on the river in the spring will be as favorable as last season, as the water will probably be higher. There will, however, be a considerable number of miners at work in any case, and no doubt if high water covers some of the bars so as to prevent their being worked it will prevent the working of others which could not be worked in low water. It is estimated that last season between \$15,000 and \$20,000 worth of gold dust was taken from the Saskatchewan, of which about \$6,000 was taken from the immediate vicinity of Fort Saskatchewan. Several hundred dollars also were taken from the Macleod river, a tributary of the Artabasca, about 125 miles west of Edmonton, on the trail to Jasper House. The gold of Macleod is in even lighter flakes and is of lighter yellow color than the gold of the Saskatchewan. The skimmings of its bars are fairly rich, but it does not promise so permanent diggings as the Saskatchewan. Thomas Smith, of Edmonton, is now in Eastern Canada preparing to make another attempt at mining on the Saskatchewan by machinery. The attempts hitherto made have always failed, but as Mr. Smith has more practical knowledge of the requirements of the case than other promoters of like enterprises he has that much better chance of success.

Major Stewart reports that by the end of next month the anthracite mines at Banff will in all probability be in active operation again, mining having been suspended pending negotiations for the transfer of the company to the English syndicate. It is thought that the new machinery will be in place by that date, and everything in readiness for a renewal of active work. The new concern will be styled the "Pacific Anthracite Coal Co."

British Columbia.

Vancouver Island.

The coal exported from Nanaimo, Departure Bay, and Comox, was shipped principally to San Francisco and ports in California; other shipments were made to Oregon, Alaska, Petropavloski, Hawaii Islands, China and Japan (per C. P. R. Steamers). H.M. Navy and U. S. War and Revenue vessels have been supplied with coal, and ocean mail steamers and other vessels calling for fuel.

The returns of the collieries show about 124,574 tons under the head of consumption in 1889, as against 115,953 tons in 1888; but it should be understood that the coal used in collieries is in most cases included in such returns.

The following statement of output and export of coal from 1887 exhibits a very gratifying rate of progress by the coal industry of British Columbia in the year 1889, viz:—

Mr. Bowron writes hopefully of the quartz interests of this section, which he thinks must be regarded as the main source from which the future wealth of this district

must flow. The successful treatment of the quartz from the Black Jack Mine, to which some reference is made elsewhere, proves conclusively that the Cariboo ores will repay the attention of capitalists. The destruction of the Government Reduction Works at Barkerville was most unfortunate, and is greatly to be deplored, inasmuch as their rebuilding will occupy fully a year's time, and miners who were awaiting their turn to test their ores will be compelled to wait until the new works are completed.

The Black Jack Quartz Mining Co., commenced crushing ore on June 1st in their one stamp Kendall Mill, and managed to put through 202 tons before the frost compelled them to close down. The ore averaged \$4.50 in free gold and \$13 in sulphurets per ton of rock crushed. In blasting the rock in the shaft the sulphurets were shattered very fine, which then mixed with the waste rock, and it was found almost impossible to separate the ore from the waste, so that nearly all the rock taken out was sent to the mill, and accounts for the low grade of the ore. The endeavour in this case was to develop the mine, and to mill what ore was taken out to pay running expenses. Sinking the shaft and milling the ore from it cost more than double what it will cost to mine and mill the ore when the mine is thoroughly opened. A shaft was sunk 42 feet deep, and a drift of 22 feet run on the ledge, when it was found that the ledge changed its course, which made it necessary to stope up an incline shaft to the surface, from which the ledge can be worked to better advantage. The incline shaft had reached within five or six feet of the surface when the mine was closed down for the winter.

Gold Mining as an Industry.

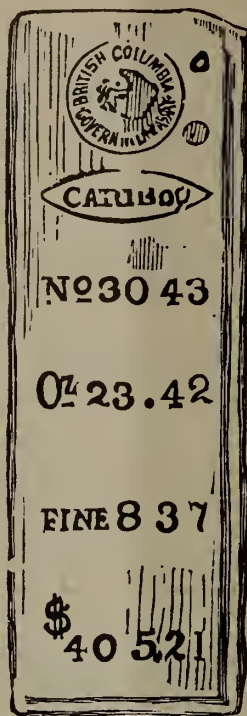
Gold mining as a speculation has received a shock; why not try it now as an industry? It suits the unscrupulous promoter and the gambling operator to manipulate a gold mine, but the investing public's interest lies in its being scientifically and honestly worked. The present position of South African gold shares in the market is a telling although painful illustration of the first method; some of the Indian gold mines may be taken as an apt instance of the second.

The mad rush to acquire claims in the Witwatersrandt, to float companies in Johannesburg or London, to set up standing machinery, to crush the best and most easily got at ore, to send home the highest returns of gold extracted, to declare fancy dividends, and, as the end and aim of all, to rig the market, has ended, as was inevitable, in wreck and ruin to many an unwary speculator. It is an old story, which will continue to be repeated until mining for the precious as well as every other metal is carried on as an industry, or, in other words, on commercial principles. As businesses are not built up by those at their head always keeping their eye on the Stock Exchange, so gold mining is not likely to be successful while the directors and managers think more of the market quotation than the steady development of their property. Mines apparently rich—such as the Salisbury, which extracted over 2,000 ounces in one month a little over a year ago—have now to stop milling, in order that necessary work which should have been done at the outset may now be undertaken. This is by no means a solitary instance of palpably bad management, reflecting as it does upon the skill, if not the honesty, of those in charge. Mining engineers may not have always a free hand, and may be required to do many things against their better judgment; but they too not unfrequently add to a want of knowledge and practical experience a desire to make a brave show, to the eventual undoing of those who place their dependence thereon. A determination to go straight through with the work, opening up and developing the mine as they proceed, doing the dead work that is essential at the outset, will not produce bloated dividends, but it will, if the conditions are favorable, make the property a steadily remunerative one, and add to their own reputation in the long run.

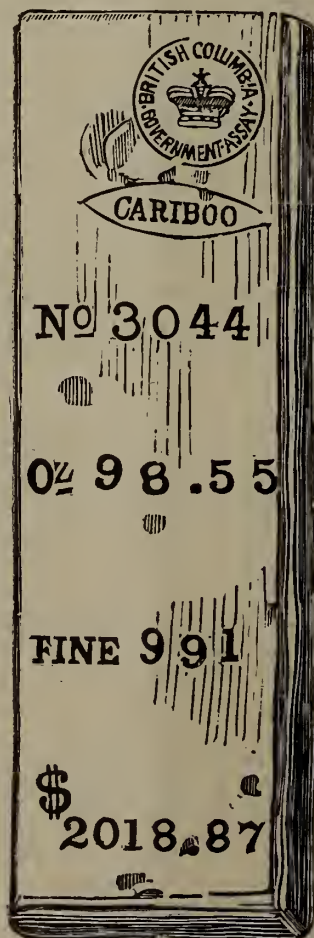
Gold Bricks from Barkerville.

Below we present our readers with illustrations of the first two gold bricks—the advance guard it is hoped of a host of others—the result of the treatment of one hundred tons of quartz from the Black Jack Mine, near Barkerville. The test was the only complete one made by the Government Reduction Works before their destruction by fire. The value of the small bar is \$405.21, the gold being .837 fine and is that saved on the plates from the free-milling ore. The larger brick is that extracted by the chlorination process from the concentrates, its value being \$2,018.80, the gold being .990 fine. Included

in the 100 tons treated were some 20 tons of concentrates previously treated, but from which only 60 per cent. of the gold had been taken. These were again treated and



another 30 per cent., or about \$325.00, secured. This would make the value of the Black Jack ore per ton to be \$21.00, a price at which it would pay well to work. Ninety per cent. of the gold in the concentrates was se-



cured by this process. These results prove conclusively that the ores from Cariboo will repay the attention of capitalists, for that they can be profitably worked is placed beyond question. We are indebted to the courtesy of the publishers of the *Colonist* for the use of the cuts represented above.

The Training of a Geologist.*

By John C. Branner, Ph.D.

The fitting of a young man for his work in life is worthy of our serious study and consideration, and while much that I may say is equally applicable to men in any calling, I can only undertake to speak of some of the demands that the times are placing upon geologists.

It is to be expected, of course, that there are plenty of persons of intelligence in the world who have no conception whatever of a geologist's duties, those who imagine that geology as a profession can be picked up just as the duties of certain civil offices, or of clerical positions, may be readily learned and performed by any man of ordinary intelligence. Among the applications I have received for employment one man gave as a reason why he should be employed that he was a consistent member of the Presbyterian church; another that he was a graduate of a famous military school; another was interested in geology and had read many books upon the subject, among which he cited some of the vaporings of Ignatius Donnelly; still another used to be acquainted with Professor Winchell, and another was in poor health and thought field work would be good for him. At least half of the applicants have asked for employment because they understood ordinary land surveying, and one of them admitted that he had no other qualification than that he was "a good hand to camp out."

The general academic training of a geologist during the first two or three years of his college course is not essentially different from that of any man of culture. I am not disposed to side with those who think that if a man is to be a specialist the sooner he begins his specialty the better. In a general way this proposition is correct, but in making such an admission it must be distinctly understood that all things which tend to broaden a man's scholarship form essential parts of his specialty.

That a man should have a knowledge of history, philosophy, social science, and of literature in general goes without saying. But as bearing directly upon his professional career he should understand, of the languages, at least the Latin, French and German. In mathematics he should have the general instruction required by civil and mining engineers, and should give special attention to astronomy and geodesy. In chemistry the more thorough his training the better, and beside the usual work required of students of chemistry, in which especial attention should be given to inorganic chemistry, he should be a skilled mineralogist and should be well acquainted with metallurgical processes. In physics the student should give attention to optics, especially as employed in the construction of mathematical instruments; to hydraulics and hydrostatics, to dynamics, and to hypsometry.

I have sometimes thought that to be a good and successful geologist one should first be a good civil engineer and then a good mechanical and mining engineer. This thought has been suggested to me by the fact that among the students I have had to train in geological work those from the engineering courses have, almost without exception, proven themselves by far the best qualified. This is due to the fact that a large part of a field geologist's work consists in tracing out in the field, and the delineation upon maps and cross sections, of structural features. In this work topographic features—the elements of horizontal and vertical distances—have to be so constantly dealt with that unless the student has pretty thorough training as an engineer he will find the work very tedious. I should make it plain, however, in referring to the desirability of a geologist having an engineer's training, that I do not mean to imply that an engineer can always step into geology and make a success of it, for it is only the very young engineer who can or will make the proper use of his technical training. As a rule, the man who has been a practising engineer for a number of years is no longer sufficiently pliable in habits of work and thought to make a successful geologist. In geology various degrees of detail are required. Sometimes our measurements need to be made with a micro-meter, at others with a foot rule, while at other times an error of several feet is of no consequence, but a civil engineer who has been accustomed to the degree of accuracy required in railway construction can not always bring himself to use now a less accurate method, and now, another of great precision, just as circumstances may require. But whether the student receives the full training of a civil and mining engineer or not, he will need to acquaint himself with practical and theoretical land surveying. He should have practical knowledge of the various methods of doing topographic work and of map making. He should be a good draftsman; he should be so trained in drawing that he can, if necessary, make his own drawings and sketches, and will know, at least, how to direct the work of others. Careful attention should be given to the preparation of rock slides and their microscopic study. In paleontology he should not only be instructed

* Presidential address before the Indiana Academy of Sciences.

in the best methods of investigation in and the application of paleontology to geologic work, but he should also have a pretty thorough acquaintance with fossil forms and their range in the geologic column.

I take it for granted that no one in this audience has any doubt in his mind about the necessity of laboratory work in training a naturalist, and I would not refer to this point at all were it not that within a couple or three months the faculty of a prominent educational institution in this country "after an exhaustive debate of three and one-half hours, decided by a vote of 6 to 5 that laboratory work in the scientific courses should not be abolished as requested by the professors of languages." Of course, one would as well try to teach a student swim without letting him go nigh the water, as to undertake to teach him natural history, chemistry or physics without laboratory work.

Besides laboratory work there is, perhaps, no branch of natural history which more emphatically demands field work for its students than does geology. This is due largely to the fact that the little indoor or laboratory work the geological student can do is directly and entirely dependent upon his field work. Then, too, in other studies we can have and do have our laboratories in which nearly all the student's observations are made. In botany and in zoology, in histologic studies and in chemistry and physics, the materials may be successfully studied in the laboratory, but the geologist, whose studies are often valuable in proportion to the range of his direct observations, can not take his stratigraphy and his topography into a laboratory. His laboratory, except in certain parts of petrographic and biologic studies and in the office work on his maps, is out of doors.

In its professional bearing the most essential part of a geologist's training should be to the end *that he observe well, and that in his deductions he properly subordinate his facts.* His preliminary technical training should therefore be for the purpose of teaching him accuracy and detail. The necessity of accuracy should be so deeply impressed upon his mind that accuracy will become a part of his nature. After this lesson is learned he must be taught speed, without sacrificing in the least his accuracy.

I believe Dr. Chamberlin, president of the University of Wisconsin, recently delivered an address before the Western Society of Naturalists upon multiple working hypotheses. I have not seen this address, but I can readily imagine that he presented in detail the advantages of this method of scientific investigation, in the use of which I am, myself, greatly Dr. Chamberlin's debtor. In my own experience I have found it of the greatest value, and I know of no better way of developing the reasoning powers or of anticipating difficulties, or of reaching right conclusions than by the proper use of hypotheses. As the whole professional training of the geologist is for the purpose of enabling him to reach correct conclusions, he should be trained in the use of every method of investigation that will aid him, and among these aids I count as of great importance that of multiple working hypotheses.

Besides having a broad general culture, a geologist must be *par excellence* a geologist, and besides being a geologist he ought to know more about some particular branch of geology than anyone else. The material progress of our times is due largely to the division of labor which enables each individual to perfect his skill. Progress in science is due in no small degree to a similar division in scientific work. Though I can not dispense with a knowledge of chemistry, specialization by my neighbor who devotes himself to chemistry relieves me of the necessity of devoting a large part of my time to chemistry; the devotion of another to physics gives me my time for geological work proper, which, without the specialist in physics, I should be obliged to devote to physical studies. The astronomer hands me the results of his special investigations and saves me my time for geology, which, without his help, I should be obliged to give to astronomy. And so it is all around. On the other hand I trust that my attention to geology will, in its turn, come to the aid of the chemist, the physicist and the astronomer.

In saying a word for specialties I am fully aware of all that has been urged against this kind of scholarship. President White, of Cornell University, said to me in a private conversation a few years ago, that he had his doubts and fears about the outcome of this modern tendency among scientific men to specialization. Said he: "If this thing goes on, we shall have after a while, a man who will know all about the stripes on a trilobite's tail, but he won't know anything else." It is very easy to ridicule a specialist, especially if the aims of his studies are not comprehended. Galvani studying the twitching of a frog's legs, Darwin breeding pigeons, and Agassiz planting sticks on a glacier, are inspiring or ridiculous in proportion as we comprehend the bearing or end of their studies. Whether studying the twitching of a frog's legs or the stripes on a trilobite's tail is an unworthy and contemptible occupation for an intelligent man depends, therefore, upon the ultimate objects of the study. And

in regard to special work by those who aspire to broad culture in science I can only repeat what I have always held upon this subject: that a man who is incapable of doing and has not done special investigation is not capable of taking a broad view of science in any of its relations. Mr. Darwin has done some of the best generalizing of our age, but before he did it he had done some of the best of specializing, and that, too, on such unpractical, uninteresting and useless animals as the barnacles.

A lofty structure can not be built upon a narrow foundation, neither can a man be great in science who hasn't broad culture. And as only close attention to minor details in the material used can secure a great building against calamity, so care and skill in special investigation—in little things as it were—are essential to a great and broad-minded man of science.

You will probably exclaim that the requirements of which I speak and which I find essential are entirely too many to be complied with; that life is too short to allow one to undertake so much purely preliminary work. It can not be denied that to become a good geologist is a serious undertaking, and all I have to reply is that this is the kind of geologist I have been seeking and am still seeking. How many have you found? you will ask. Not many, I must confess. Indeed, men with such preparations are few, and when one finds them, he doesn't find them "looking for a job;" their services are always in demand. I may say, however, that it is not to be expected that the student should get all this training as undergraduate work. College men going into law, medicine and theology, if they get the technical training required by their professions, spend two or three years in law, medical or theological schools. The geologist must do what amounts to the same thing—that is, he must, beyond his general training, qualify himself specially for geologic work. When our geologists are so trained we shall have a better science, better geologists and better results all around.

The demands that are made upon a geologist require no particular kind of an intellect, save, of course, that it be a good one, but broad culture and broad mental grasp are essential to the pronounced success of any man in any calling. A man is wanted not to work up this or that deposit as it may occur in some limited area, or this or that formation, and much less some county or other artificial area, but who, in working up a topic, can and will take up the problem as a whole, and study it as a whole, not in one locality, but wherever it may be found in the world, who can work up the bibliography of his subject, and who can sift and put to good use the facts gathered by others in his deductions, and whose knowledge of allied sciences will enable him to draw proper conclusions from his facts, while his knowledge of affairs will render his judgment upon economic questions of the greatest value.

But it is not my purpose to confine any remarks to the technical training of the geologist, but refer also to certain general and ethical features of his work which call for a training or fitness to which educators give too little attention. I hardly know whether any instructor ever troubles himself to impress his students with the ordinary requirements of professional etiquette; I don't remember ever having heard the subject mentioned in a class-room. We seem to have depended upon men's instincts as gentlemen for shaping their professional conduct.

To be a successful geologist one must be a geologist very largely because he can't help it—because he can't keep out of it. I mean, of course, that the science must so fill the demands of his mind, his temperament, and his health, that in another occupation he feels that he is not where he can make the most of himself and of his energies. Such men will have that professional pride without which everyone is doomed to a fatal mediocrity. The man who goes into geology because there is money in it will, in nine cases out of ten, make a total failure of it. To be sure a living must be had, but he who has the right training and the right interest in his work will never lack for lucrative employment for any considerable length of time. It may sometimes happen, however, that a geologist is without such employment for a while, but it should be distinctly understood that such times are not to be given over to demoralizing idleness. The world is too full of problems of scientific interest for any man having a scientific spirit to stand idle for a single day or a single hour, and no one having such a spirit will stand idle.

In the balancing of the essentials and the non-essentials in the training of a geologist certain economic considerations have, almost without exception, to be faced. Those of us who devote ourselves to pure science are constantly being wearied with that most tiresome of all questions about the practical value of what a man reads about, thinks about, or does. So long as the young see around them examples of men who have become wealthy by the successful application of some law in science, by the invention or discovery of something that people are willing to pay handsomely for, just so long shall we have these young men asking how this and that study, this and that bit of training are going to be of any use to

them. As men who love science for its own sake, we get weary of such questions, and some of us feel driven, in order to emphasize our warnings, to avoid the useful altogether. Thus we occasionally have, on the one hand, men who have a horror of doing anything that is liable to be of practical value, and on the other, men who have no patience with an investigation which does not promise some tangible, material reward for their pains. My opinion is that there is little to choose between in these two types. One of them is just as far wrong as the other.

There are many pitfalls in the pathway of the geologist—many inducements for him to profit just a little too much by his experience. His duties are often of a very delicate nature. He is called upon to examine and report upon properties where large sums of money are involved, and where the information obtained in his professional work might be used by him for his personal advantage. The importance of a right way of thinking and acting in this connection is of the utmost importance, for if one does not conduct himself properly just here he is liable to gain a good share of the whole world "but to lose his own soul." I am reminded to quote the man who advised his son to avoid the appearance of evil: "Never mind the evil itself, but avoid the appearance of evil." This is, of course, a perversion of good advice. "Avoid the very appearance of evil and evil will avoid you," is good advice for the geologist, as well as for other folks.

I may say briefly that a professional geologist, especially if he is in a public place, such as State geologist, or is in any way connected with a State or national survey, has no moral right to have a personal interest in any mining property, or in any other property a knowledge of the value of which might come to him through his knowledge of geology. Abstaining from such interests is a duty the geologist in public employ owes to himself as well as to the public, and the public has the right both to expect and demand that its employees shall not walk off with the profits of its investments, just as a manufacturer has the right to demand that his employees shall not appropriate the articles they make. The geologist not in public employ who becomes personally interested in mining operations, even when he does it in the frankest, most open, and most upright manner, and with no idea of doing otherwise than as any citizen may honorably do, does nothing wrong in itself, but he must remember that he does so at the risk of his reputation and standing as a consulting geologist.

The man who is not willing—does not try—to save his energies, may be relied upon to not give the world the benefit of his best services. How often we see men who had an idea that there is some virtue in doing a thing the hard way, who, when suggestions are made for the purpose of saving their energies, assure us that that is all right, that they'll get it done, and if their way is a little harder, they are the losers by it.

A certain engineer has a three-sided scale in his drafting room. There are six different scales cut upon it. A person using this scale is liable in taking it up to turn the wrong division upon his line, and, in order to avoid this risk, and to save the time and thought that must be used in watching to see that one doesn't get the wrong side, a simple piece of metal has been devised to clasp it in such a way that it is impossible to use the wrong side. Some of his assistants remove this safety attachment, because they are not "used to it" and insist on running the risk of making mistakes and of using up the time they are paid to work, in examining their scale to see whether they have turned it over. Another man doing topographic work doesn't want to signal to his assistant, preferring to call out his directions to him at long distances, often more than a quarter of a mile, so that at the end of the day he has done three-quarters of a day's work on the topography, and the other quarter in yelling—a bit of labor the geologist can not utilize. These mistakes are unpardonable errors of judgment, and young men should be warned against such. If we spend our time and energy in unnecessary work we shall have just so much the less energy for the essential. There may be some excuse for the man who isn't able to discriminate between the essential and the non-essential, but in such cases as those referred to, and indeed in the majority of cases that arise, there can be no such question. In his methods the geologist must always be willing to profit by the experience of others. Methods and appliances of research are constantly being improved, but these improvements are made, not by disregarding the experience of others, but by making every possible use of it.

There is sometimes a tendency among the newly fledged to imagine that those who have gone before them have not taken the greatest pains in their work, that their conclusions have not been warranted. They therefore begin with the idea that by the application of superior, or, at any rate, new methods of investigation, they are going to upset everything done before they began. Such persons often succeed in making asses of themselves, and end their careers before they begin them—that is, they make careers impossible.

I had occasion recently to go over the work of one of our older geologists—work done under the most adverse circumstances. This work had but a short time before been very sharply criticised by an aspiring young geologist, and I was prepared to find either one of them right. I not only found the work of the older geologist well done, but I was astonished at the clearness of his perceptions and the general reliability of his conclusions. The young man had committed a blunder from which his reputation can never recover.

The necessity of caution on the part of the young geologist in publishing conclusions that one feels to be open to criticism, or when he sees that important facts may be overlooked, can not be too strongly emphasized. The publication of facts is generally useful, but deductions can afford to wait until they are properly matured. A most valuable piece of advice once given me was to the effect that young people would better not begin pumping out their intellectual reservoirs before something has been pumped into them. Life is too short, and progress all along the line is too slow for us to cumber the march of science with verbose discussions which help toward strife and contention instead of towards truth and union. To be sure "ignorance is no reason with a fool for holding his tongue," but my advice is not intended for fools, who will be fools in spite of everybody and everything, but for those who, having sound sense, desire not to appear fools or to bring discredit upon themselves or upon the science to which they are devoted.

Science is not infrequently charged with vacillation. Apropos of this, one of our humorists has the following: "Science says—but no matter what science says, for the next time she says anything she'll say just the opposite." We cannot deny the justice of the criticism, but this bad repute is to be attributed entirely to premature utterances. We have some sad examples in this country of poor geologists whose premature conclusions, drawn from too hasty or incomplete work, have kept half a dozen good geologists busy for years in correcting their mistakes and in putting the truth before the world. Their excursions into geologic fields are like the inroads of lawless and unclean animals that require a score of persons to clean up and put things straight after them. These busy bodies have, almost without exception, an itching for notoriety that leads them to seek some scientific short-cut by which to arrive at distinction, but if there is a balancing of accounts either here or hereafter, these men are destined to have a distinction in the scientific world of quite another sort from that for which they are pining. They are usually men of good enough intentions, but, as one of my preceptors once reminded me: "we have a right to expect something more than good intentions of men." All people mean well; it is our business to do well.

Sensationalism has done and is doing great injury not only to geology but to other branches of science. There are certain features about every science that impress the ignorant with their novelty, and there are certain persons who are always ready to make capital out of them. This gives rise to a sort of "O my!" class of men, and to an "O my!" kind of science. Their delight in the startling. None of the more radical theories of science, theories put forward by the right thinking with great caution, stagger them. Man's descending from a monkey never troubled them; they always thought so, and can point out cases of dissent that would make Mr. Darwin or Mr. Wallace catch his breath. This skimming the surface, this dilettanteism is strong in our times. In the geologist's training the less we have of the sensational the better it will be for the science and for the man.

It is not a pleasant thing to be obliged to destroy the delusions which people hold so lovingly close to their hearts, but the conscientious geologist has a good deal of this disenchanting to do. And nobody even thanks him for it. The very persons he may hope to serve in telling them the truth, will, in all probability, never believe him and never forgive him. But a good geologist has to face a great many disagreeable duties, and if he hasn't the moral courage to tell the plain, unvarnished truth, and to take the consequences, when a white lie would smooth matters over all around, he will find his troubles increasing as time goes on. One lie, whether it is a white one or a black one, only makes room for two others, and the man who makes two lies grow where but one grew before deserves no good of mankind.

Those who are at once workers in science and teachers of science know how difficult it sometimes is to draw a sharp line between what we know and what we simply believe, but as far as possible this distinction should always be kept before the minds of students, and no effort should be spared to prevent that dazzling of their minds which prevents them from weighing evidence and from distinguishing between simple truth and simple figments of the imagination.

And now just a word about our responsibilities to our own intellects. Intellect is the tool with which the geologist has to do his work. If that tool is bent out of shape or dulled by improper use it cannot perform its

functions properly. It is highly essential, therefore, that he keep his intellect unimpaired. He should strive to keep his mind free from those tricks of logic, rhetoric and sentiment by which so many of us allow ourselves to be imposed upon. Those of us who are naturalists and investigators at heart, as well as by profession, are not satisfied with declaring, like the humorist, that we are "open to conviction," while parenthetically we add, but we'd just like to see the man who can convince us." We are bound by every sentiment of honesty to go where our evidence leads us, whether it takes us to a pleasant place or not. Truth must be our companion whether she be an agreeable or a disagreeable one—a handsome or an ugly one. We cannot honestly say to reason "thus far shalt thou go, but no farther." We can't reasonably follow the science of geology to a certain point and then abandon it for the divining rod or spiritualistic seances or clap-trap appliances of any kind. The man who has no notion of accepting the results of his reasoning would just as well not reason at all, while the man who undertakes to reason within certain limits insults his intelligence. All honest men are seeking the truth; and is it not our duty to help others in this search when we can? We may be sure that if we wait till all the world thinks alike, the world will never care what we think.

I have said that the profession of a geologist requires certain proficiencies that are common to successful men in any and all occupations in life. Good judgment, clear insight, business habits of thought, and promptness of decision and action are as essential in geology as anywhere else, and it has often seemed to me to be even vastly more so. It is enough that one should plod faithfully ahead with a task—though faithful plodding is not to be underestimated at all. The man who grasps a subject in all its bearings, takes hold of it with judgment and solves its problems with courage and logic is the one who really advances the cause of truth, the cause of science, and the cause of humanity.

Once upon a time a business house employed a young man whose energy and grasp of the business of the firm induced the head of the house to promote him more rapidly than an old and faithful employé. The old employé felt deeply hurt that this dapper young fellow, who parted his hair in the middle and wore eye-glasses, should be advanced over him, and he took occasion to complain of it to the senior partner. The senior partner felt it to be a case that he couldn't very well argue with so faithful and tried a servant. There happened to be a lot of waggons passing the door of their building at the moment, and, as if changing the topic for a minute, he asked the old clerk what was making all that noise. He went forward and returning told the partner that it was a lot of waggons going by. He then asked the clerk what the waggons were loaded with. He went out again and returned and reported that they carried wheat. He sent him again to know how many there were of them. He returned with the reply that there were 16. Again he sent him to ascertain whence they came, and he returned saying they were from the city of Blank. The senior partner then asked the clerk to be seated, and, sending for the young man complained of, said: "Will you see what the meaning is of that rumbling noise in front." The young man replied: "It will not be necessary, for I have already ascertained. It is caused by some waggons—36 in all—16 in this lot, & 20 more to pass to-morrow. They belong to Pinto & Rosa, of the city of Blank, and are loaded with wheat. They are on the way from Blank to Zee, where the supply of wheat is short, and is now fetching \$1.15 a bushel, while it costs but 90 cents at Blank. The waggons gets 15 cents a bushel for hauling it, and each one carries 100 bushels." The young man was then dismissed, and the senior partner, turning to the old clerk, said: "My friend, you see now why Mr. So-and-so has been promoted over you."

This illustrates the demands, not of business men alone, but of geologists, and of everyone who employs others, either directly or indirectly, or who associates others with himself in his work. We all want men who can not only do the very best and most comprehensive scientific work, but who comprehend their duties in all their relations, meet emergencies, with prompt and clear judgment, and save us and our energies for other affairs. And we don't want to be obliged, in order to get out of a man what there is in him, to stand over him constantly and to direct his every effort.

Coal Mining Machines.—Mr. G. Blake Walker at a recent meeting of the Federated Institute of M. E. of Great Britain, said that the function of all these machines was to undercut the coal in the same way as had hitherto been done by hand labor, but with more rapidity and less waste. So long as seams of fair thickness were worked, and skilful holers were obtainable, there was little advantage to be looked for in the introduction of machinery, but as thinner seams were opened out, and the skilled workmen became rarer, the amount of waste caused it to be absolutely necessary to adopt some

expedient, as under the old system half the output of a tender seam would pass through the screens. Mr. Walker went on to make a comparison of the actual cost of coal-cutting by hand and by machine, based upon experience. He assumed that in a 3 ft. seam, with a favorable holing material, the quantity of slack made when the holing was done by hand was 25 per cent., and when done by machine 15 per cent. In a seam 1 ft. 6 in. thick he had taken 45 per cent. for hand labor and 30 per cent. for machine, as in the case of so thin a seam the coal would be more broken, from the difficulties inseparable from its working. Actual experience pointed to 100 yards per eight hours shift as being a satisfactory performance when the ordinary conditions of working a coal face were in force. The general result showed a saving of from 8½d. to 1s. 6d. per ton, of which two-thirds roughly were obtained from the reduction of small, made when machines were used.

British Columbia Collieries in 1889.

Mr. Wm. Dick, Inspector of Mines for the Province of British Columbia, contributes to the report of the Minister of Mines a mass of interesting and valuable information respecting the progress of the coal trade during the past year. We reproduce his description of the various colliery workings:—

Nanaimo Colliery.

The coal in this colliery was in good demand up until the last two months, when the mines had to stop work, owing to there being no ships to take away the coal.

No. 1 PIT, ESPLANADE, IN NANAIMO.—This mine, forming part of the Nanaimo colliery, belongs to the New Vancouver Coal Mining and Land Company, Limited. The working in this pit is by what is known as the No. 1 and No. 3 North Levels. The No. 1 Level is in a north-westerly direction about one mile, and in this district of the mine there has not been much coal mined during the past year; but there has been some extensive prospecting done, and the company, to all appearance, is going to be rewarded for their perseverance, as they have now got into thick coal, that, from the prospect and regularity of the seam, I think, will prove to be a large and profitable coal field; they have now got into this coal 200 yards, and it averages about seven feet thick, clean and hard. The great part of the coal got out of the mine in the past twelve months came from No. 3 North Level, and in this level they have the prospect of getting into the same coal soon that they have got in No. 1 Level. Ventilation in this mine is very good. When I was down in December I found 49,000 cubic feet passing per minute for the use of 60 men and 14 mules. The motive power of the above air is a Murphy fan. There is very little gas now found here, the mine being free from dust; and there are pipes to conduct water when required.

No. 3 PIT (CHASE RIVER).—This shaft takes its name from being near to the mouth of Chase River; it is about two and a half miles from Nanaimo and forms part of the Nanaimo colliery. The coal in this mine has been, and is at present, hard and of a very good quality, although varying in thickness from four to ten feet. All the workings are by way of a slope starting from near the bottom of the shaft, the levels branching from the slope. The coal is worked here on what is termed the pillar and stall system, for which it seems well adapted. Ventilation is very good; motive power, a large fan on the top of the upcast shaft. When I last inspected this mine there was 46,800 cubic feet of air passing per minute for the supply of forty-six men and twelve mules, and it is well conducted into the face by brattice or otherwise. This mine has been free from gas since it started; the mine is also free from dust, being wet throughout. In this mine, as in all the other mines of the Nanaimo colliery, a deputation of men is sent to examine the mine, under section 79, general rule 31. The finding of the condition of the mine is recorded in a book kept for that purpose, and a notice is put up where all may see it.

SOUTH FIELD MINES, NOS. 1 AND 2.—These mines are now known as the South Field Mine, both places being worked into each other and have jointly one ventilating shaft. During the past year a few men have been taking out coal along the outcrop of the No. 1 tunnel, but the bulk of the coal came out of the No. 2 slope. This slope is down over 700 yards with an easy grade until approaching near the face, when it goes off with much greater pitch. About one-half of the output of the Nanaimo colliery came from this mine. The coal is of very good quality, and from a series of bore holes put down from the surface to the coal, some distance ahead of the working, they have proved that they have a great extent of coal yet before them. This is also mined on the pillar and stall system. There is now a long range of stalls in good coal.

Ventilation is very good; motive power a large fan on the up-cast shaft. This mine is ventilated on the separate split system, with two divisions to the east side

and one to the west side of the slope, the intakes being the Nos. 1 and 2 slopes with a shaft between the two slopes for the return. The last time I was down this mine I found that there were 67,500 cubic feet of air going past per minute for the use of 74 men and 7 mules. There is very little gas found in this mine, and it is free from dust, being damp throughout. Here the workmen also take the privilege of section 79, general rule 31.

No. 4, SOUTH FIELD MINE.—This is the new slope mentioned in a former report, situated about half a mile in a southerly direction from No. 3 pit. They have gone to a great expense here. The slope is now down about 700 yards, the coal being thin in some places, and at other times no coal; but it was reasonably expected that good coal would be found as in No. 3 pit, coming towards this slope the coal was hard and from five to nine feet thick; it is, however, to be hoped that they will come on the coal soon. **NORTH FIELD MINE.**—This is the northern part of the estate, owned by the New Vancouver Coal Mining and Land Company, Limited, and is situated in Mountain District. In the year 1888 the company put down a series of bore-holes to the coal, and among them was one near to their boundary line, which adjoins the Wellington property; the prospect they got seemed to justify them in putting down a shaft. The contract was taken by Mr. R. Scott to find the coal. Great preparation was made, clearing away timber and levelling off the surface, and a steam engine was erected. Everything being in order, work was commenced in the shaft on the 8th January, and continued without any great stoppage or drawbacks, when on the 31st July, coal was struck, the same as is known both here and in California as the Wellington coal. This was at the depth of 424 feet from the surface. In passing through the coal they found that it was of very good quality and hard; there were three plys of coal with rock between them, making about seven feet of coal. The shaft was continued until they got down 445 feet from the surface. Everything having been got in order both on top and at bottom they then started in the coal, when they found they had a small fault; but now that they are getting fairly started with levels and a slope opening out to both sides they find that the coal varies in thickness from three feet eight inches to four feet four inches, and is very hard and of a good quality. They have got out a few thousand tons of the coal and it looks well. When Mr. Scott had the shaft finished he received charge of opening out the mine, which is to be carried on, on what is called the long wall system; and it appears as if it should work well, as the roof is stronger than the roof of this vein generally is.

Ventilation is good; motive power, a fan on the Murphy principle. The last time I was down there were only four men in the mine, so that they had the fan running slow; but at that time there 10,000 cubic feet of air passing per minute. There has not yet been any explosive gas found in this mine, and everything is being done to make the workings as safe as possible.

The shipping place from this mine will be Departure Bay Point, where a large wharf has been erected by the company, so that the largest ships may load at any stage of the tide. From this wharf to the mine, with sidings, there are five miles of railway of standard gauge. There is also a railway in connection with the Esquimalt and Nanaimo railway.

In starting a new work like the North Field Mine, a large outlay of capital is required, and it is desirable that the enterprise shown by the company will meet with the success that it deserves financially; it will also give new life to this district. I may here be permitted to remark that the prospect of the company for coal in their several mines for the coming year exceeds any that I have ever seen them have, and I trust that it will continue so.

Wellington Colliery.

No. 3 PIT.—This is the pit mentioned in a previous report as being in the valley of the Millstone River, and, as I have stated in former reports of this mine, is all by the way of a slope on the south side of the shaft.

The coal was worked on the pillar and stall plan, which is the general method in this colliery. There are now very few stalls being worked, but there is considerable mining being carried on at the pillars, which will last for quite a long time, as the pillars are fully one-half of the coal.

Ventilation is very good. When I was last down, in December, upon taking it I found that there were 40,000 cubic feet of air passing per minute for the use of 37 men and 6 horses. The mine is ventilated on the separate split system, going direct down the slope and returning by way of the pillars and stalls; motive power, a large fan. In ordinary times there is little gas found, but sometimes, when the roof breaks when they have taken out the pillars, then considerable gas comes away. When, however, there is the least danger the men are sent out of the mine. Here, as in the other extensive mines of the Wellington colliery, a deputation from the men goes through the mine once a month, to examine all the mine to know its condition as to its safety, and the

result of their examination is recorded in a book which is left open so that any person may see it.

No. 4 PIT.—This pit is put down on the top of the bluff which overlooks the Millstone River Valley. They have been working steadily here the greater part of the year. The coal is worked from what are known as the north and south side workings. All the working in this mine has been on the pillar and stall principle, excepting a small place in the south side, which is now back again to the old style. The coal generally in this extensive mine has been very good, yet the mine has not been without its faults. This mine and No. 3 pit are connected at different places with open roads from one to the other, that is, on the south side. Beside the connection they have their fan shaft, by which men could be taken out if emergency required it.

Ventilation is very good; motive power, a large fan on the top of the upcast shaft, worked by a steam engine. This mine is ventilated on the separate split system—the two main divisions at the shaft and again further in the workings. The workings here are very extensive, spreading over a great area, but the air is well kept under control by the overman, so that one district is not overdone at the expense of another. After the air has travelled round its several districts, it is again merged into one volume, and then ascends the up-cast shaft, worked by a steam engine. Sometimes I find the air passing a given place at the velocity of 1,500 (one thousand five hundred) feet a minute, and the last time I was down, in December, I found that there was 110,000 cubic feet of air passing per minute for the use of 150 men and 10 mules and horses.

This mine gives off some gas, which comes from the roof where they are taking out pillars, but is not allowed much chance to collect. The fireman, in going his rounds in the mine, seldom finds any gas in the stalls. The mine is free from dust, as there is throughout the mine, where they may be required, a regular system of pipes, so that water can be turned on at any time, either to lay dust or in case of fire.

In addition to the overman and fireman, there is a staff of men called shot lighters. They use and have only safety lamps to ascertain if a place is safe and if a shot is properly prepared before they will light it. In this mine there is a monthly examination by a deputation of workmen made in the manner before described.

No. 5 PIT.—This is the only pit of the Wellington colliery which has a railway connection with the Esquimalt and Nanaimo railway, and it plays a good part in supplying the Victoria market with this famous coal. This is now about the most extensive mine in the district. The coal is brought to the shaft from the east and west levels incline from the south, and a slope on the north side. In all those places the coal has been and is now very good, and they send out fully 500 tons in one shift. The workings here have all been on the pillar and stall principle, except a small piece in the slope, which seems to work very well.

Ventilation is very good, and well conducted into the face and where they are taking out pillars (coal) by brattice or otherwise. When I was down in December I found that the instrument registered 118,420 cubic feet passing per minute, that is to say: 45,230 on the east side, 51,460 on the west side, and 21,730 cubic feet per minute passing in the slope, but the above mentioned currents of air are again divided further in the workings so that each district will have fresh air. The total number of men employed here on one shift is 195, and 14 mules. This mine is free from dust, and no expense is spared to keep it so. They have a regular system of water works or pipes to take water to any part in the mine where they think it may be required, and, as I have said in a previous report, the mains are along the levels and main roads, with small pipes and hose to the stalls, with sprays of water blown off at different places in the mine, the air carrying the moisture along, so that everywhere it is not only damp but wet in top, bottom, and sides. The pipes are supplied with water from a large reservoir on the surface, the pressure being the depth of the shaft—260 feet.

This mine is examined monthly by a deputation from the miners here, and chosen by them, to look into and examine every part of the mine under the section and rule already referred to.

No. 6 PIT.—This pit was mentioned in a former report as No. 6 Sinking Shaft, about 900 yards east of No. 4 pit. They continued at work without anything serious happening, when, about the 1st of May, coal was struck at the depth of 340 feet from the surface. The coal was found to be eight feet thick, very hard, and of the usual good quality of the Wellington seam. Since that time they have been opening out to all sides, and have now got quite a distance away from the shaft all around. They are mining on the pillar system, as this seems to be adapted to the purpose, all things being considered. The coal has proved to be very regular and good, some places not quite so thick, but other places much thicker. This is now a valuable mine, and is proving an acquisition to this district, there being a large number of men working here.

Ventilation is good; motive power, a steam jet, but they are now preparing to erect a fan. They are at present restricted to a certain number of men, so that the output of coal is small to what it will be in a short time, as they are mining with all haste to get a connection with their No. 5 pit. Then we may expect to see the output of No. 6 pit come to the front, for, from what can be seen, they have here got the coal to work on.

No. 2 SLOPE.—This is a new mine started by Messrs. Dunsmuir & Sons in the Sabiston and Horne property in Mountain District, and to the east of the East Wellington colliery. This slope is now down 150 yards. At the top they soon got into the coal, which was about five feet thick, good quality and hard; but after going some distance they got down through it, which put the coal away below the line of the slope which continued in the rock. They now again expect to get into the coal soon. If it is as good and as thick as it was above the fault, and there is no reason why it should not be, it will make a valuable work in this locality, and is not far from Nanaimo.

East Wellington Colliery.

This is the property of the East Wellington Coal Company. In this colliery there are two shafts known as No. 1 and No. 2 pits, although both are connected by their workings underground. By the windings of those works they are 1,400 yards apart, but by a direct course they are only about half a mile distant. The No. 2 is west of No. 1.

In the west side of the No. 1 shaft they are not now doing much mining, as they are only employing a few men, coal being thin. What coal they do take out is of a first-class quality, with a strong roof, well adapted for long wall work, which has been their method of working since they started. In the east side they have during the past year done much prospecting, which is looking favourable for having good coal on this side, although they have drifted through considerable bad and barren ground.

On August 24th there was a serious fire in this shaft. Everything went on as usual until away in the afternoon, when volumes of smoke came out of the shaft, shortly after followed by flames. Then it was apparent that the ventilating furnace had set fire to the timbers of the shaft, and in a short time the head gear was on fire, and a large bin of coal near the same, while the machinery and boilers were only a few yards off. The men were got out by No. 2 shaft, that being afterwards covered and thus shutting off the air from below. By this time the fire engine was brought out from Nanaimo, and after placing it in the bed of the Millstone river they commenced work. It then became evident that the fire on top was not going to last long. As soon as possible they got No. 1 shaft covered, and in this way the fire was put out. Considerable damage was, however, occasioned by the fire burning out some of the shaft timbers, and also to the head gear, which took a few weeks to put in working order.

No. 2 PIT, EAST WELLINGTON COLLIERY.—In this pit work has been going on steadily all the year, except for a few days when the fire was at the No. 1 pit. The coal here has been kept good and continues so. The roof, however, is not quite so strong, yet it is well adapted for long wall work, and this is the system that has been generally worked here.

Ventilation is good. Motive power up to the time of the fire was a furnace with a steam jet; since that time it has been a fan, worked by a steam engine, that does its work very well. When I was down in December, I found 20,000 cubic feet of air passing per minute for the use of 60 men and 6 mules, this being the air and men of both pits, No. 2 being the intake and No. 1 pit the outlet. This mine gives off some gas, but chiefly when the roof breaks. As the air goes along the coal face the gas has not much chance to collect and the works are well filled up. Every precaution is used to prevent accidents of any kind.

Union Colliery, Comox.

You will have seen in a former report that this colliery is the property of the Union Colliery Company. Their present mines are only a few miles from the flourishing Comox settlement.

In this property the coal is exposed in various places, and at present they are mining at three different places and in two veins of coal.

No. 1 and 2 tunnels go into the hill, being adit levels on the south side of the railway. They are in about 500 feet each, coal being about the same quality, which is very good and hard, and on an average three feet thick. This is worked on the long wall system. The roof is very strong.

Ventilation is good; motive power a furnace, the air going in by the level road and coming out by the way along the face of the workings. There is no gas found in here. The mine is free from dust, being wet throughout.

No. 1 SLOPE, UNION COLLIERY.—When previously reporting on this slope I stated it as being down 1,000

feet. It is now extended to about 2,000 feet. They have been considerably troubled with faults of one kind and another. The coal, when free from faults or troubles, is about four feet high, of good quality and very hard. The workings from this slope are at the present time by four levels, one to the south side, and three to the north side. In some of these levels the regularity of the coal has been, and is still improving as they go in.

Ventilation is good; motive power a fan on the upcast shaft, built on the Murphy principle and driven by a steam engine. The last time I was down there were only three or four men in the mine, and they had the fan running slow, as it was not required at the time to go fast, yet I found that there were 20,000 cubic feet of air passing per minute. This mine gives off some gas, but it has very little chance to accumulate. There is no dust in this mine, which is wet throughout. Everything is in good order.

NO. 1 SHAFT, UNION COLLIERY.—This shaft is about half a mile south of No. 1 Slope, and is about forty feet deep. There has been much prospecting done at this place, but they do not seem to have got right on the coal yet, although it has much improved of late, and to all appearance they will get on to a good seam soon. In this district the coal has not yet proved to be quite as thick as was expected, but the quality is all that could be desired. It is to be hoped that the company's expectations will be fully realized and that the coal may get thicker. They have put down to the coal a series of bore-holes. These bore-holes are away ahead and to the dip of the slope. In some of those holes they found a good and encouraging prospect. After the large expenditure of money here, and in view of the outlay still required to prove the property, it would be a serious matter for the province as well as for the company if these mines were not a success; but it is only a question of a short time in my belief, judging from the indications, when these mines will be successful and when there will be flourishing collieries in this district of Comox.

Tumbo Island Coal Mining Company.

This island, lying at the south-east entrance of the Straits of Georgia, is being prospected for coal by the above named company. They commenced by putting a bore-hole down close to the water's edge; in this they passed through about five feet of hard coal. This prospect so encouraged them that they went down to the dip and started to sink a shaft, in which they are now down fully 100 feet. They have a steam engine, pit head gear, and other necessary appliances. Owing to the location of this shaft being so far to the dip of the bore-hole they do not expect to get to the coal at less than about 600 feet from the surface. This is a large undertaking, and will take a large amount of capital to reach the coal and put everything in order. It is to be hoped that when they get the shaft down they will find the coal as good as expected.

Prospecting.

There has been some very extensive boring in this district during the past year. Amongst them was the continuation of the bore-hole referred to in my previous report in No. 2 Esplanade Shaft. This was put down to the depth of 1,263 feet, the depth of shaft being 617 feet, makes the total from the surface 1,880 feet. From not having struck any coal, there was another bore-hole put down by the same company in the South Field. In this bore they passed through a seam of hard coal 12 feet thick, at 469 feet from the surface. This bore has been continued till the present time, and is 1,460 feet down. This bore shows a good prospect, and is very encouraging.

Oyster Harbour Coal Company.

Exploration with two diamond drills has been in progress at Oyster Harbour and Chemainus Bay during nearly the whole of this year. The first bore, commenced in January, was put down at the head of Oyster Harbour, on the north-west side, and pierced a depth of 1,300 feet through sandstone and shale, and was stopped in a fine-looking sandstone. The rocks at this place are tilted at a high angle, the cores from the bore showing a dip of some 25 degrees. While in process of boring, inflammable gas extended from this hole in sufficient quantity to burn with a bright flame when a match was applied. A second bore was started on the eastern side of the harbour, which, after going down 690 feet, was stopped for want of water. The stream which fed the drill dried up and the machinery was removed. A third hole was bored on the north-west side of Chemainus Bay, close to the water's edge. This hole was sunk to a depth of 1,600 feet, using up all the rods available, and operations were suspended. The rocks, as shown by the cores, which are sandstone, mostly, with shale bandy, are all said to be of the right kind, and we may expect to hear more of operations in this neighbourhood. At Chemainus Bay, after getting down 300 feet, measures were found to be lying horizontally, and very nicely bedded the whole depth of the bore.

Outbursts of Gas in Metalliferous Mines*

(By Bennett H. Brough, Assoc. R.S.M., F.G.S., F.I.C.)

The recently published volume of the Reports of the Inspectors of Mines to Her Majesty's Secretary of State contains an account of a lamentable accident, caused by a fire-damp explosion, at the Mill Close lead mine, at Darley in Derbyshire, on November 3, 1887. This mine, which is the largest and most productive in Derbyshire, is one of the oldest in the district, the records of the quantity of ore raised going back as far as the year 1684. The vein is frequently many yards in width, and traverses hard limestone overlain by shale. Ore is also found extending into many of the beds of shale. Fire-damp has occasionally been found in this mine, but only in small quantities. In 1886, however, two explosions occurred, by which two men were burnt. Since that date the quantity of gas emitted from the shale largely increased, and led to the use of locked safety-lamps. The account of the recent explosion given by Mr. Stokes,† H. M. Inspector of Mines, is substantially as follows: On the morning of the accident, six miners went to work at a part of the mine called the forefield. They descended at midnight on November 2. Upon their arrival at their working place, the men tested for and found gas in and about the ends of the forefield. They thought, however, that the use of safety-lamps protected them from all danger. A shot was fired during the early part of the shift, and at 3 a.m. three shot-holes were bored, within 3 or 4 feet of where the gas was known to have accumulated. These holes were charged with dynamite, and ignited by touch-paper, and a fuse carried down from the upper to the lower workings. After lighting the fuse, the men retired to what they thought was a place of safety about 50 yards away in the lower level or waggon way. At this point they were joined by the two waggons, and all awaited the firing of the shots. Suddenly an explosion occurred, and immediately 5 of the 6 men were buried and killed by a large fall of timber and stone. The sixth man escaped with burns and serious bruises. This man stated at the inquest that the explosion took place immediately after he heard the first shot go off, and from his evidence there can be little doubt that the first dynamite shot fired the gas.

The Yoredale shale, whenever it occurs in beds of 25 to 35 fathoms in thickness, always gives off a little gas. Probably this gas had collected in the fissured limestone, and, becoming ignited by the shot, forced down the rock masses upon the unfortunate miners.

This illustration of the disastrous effects of a fire-damp explosion in a metalliferous mine clearly proves that fire-damp, unfortunately, is not confined to collieries. In a number of cases it has been met with in mines of lignite, salt, diamonds and metalliferous minerals. It has, therefore, been thought that it would be of interest to collect the records of cases in which outbursts of gas have been observed in metalliferous mines, with a view to arriving at an explanation of the phenomena.

Numerous cases are recorded in which, as at the Mill Close mine, fire-damp has been emitted from the Yoredale shales of Derbyshire. According to J. Farey,‡ in Eyam registry, there are records of men having been killed in Stoke sough (adit-level) in 1732, 1734 and 1778 by explosions of fire-damp. Pilkington§ records several men having been killed by an explosion of "inflammable air," in driving the famous Hillcar sough, near Youghreave. This adit-level passes through the Yoredale shale for two or three miles, and, with a candle at the end of a stick, up to a very recent date, visitors used to light the thin stream of gas along the roof. This would flash along almost the whole length of the level. The gas is now exhausted, or is present in very small quantities, but, when new ground is cut, there is a decided emission of gas.

The emission of fire-damp from the Yoredale shales can be easily accounted for when the bituminous nature of these shales is considered. The occurrence of solid and liquid hydrocarbons in the Yoredale shales, and in the veins near or under them, has been noticed for many years. Dr. T. Short,|| writing in 1734, gives the following account of the Huckle Edge vein near Eyam:

"It is remarkable that in the lead mines . . . was a bed of boulder stones, any one of which being broken into contains from half a pint to a gallon of soft bitumen like Barbadoes Tarr, it melts before the sun or fire to oil; there were also several springs in the mines, that took fire with a candle and would burn a week or fortnight, and all the water drilling through this stratum of boulder stones will take fire and burn many days. This bed was continued between two or three miles, all along Hucklewedge with its burning waters. Several damps have

happened at these mines without any preceding visible cause or sign, but all being serene and clear in the works without fog or mist; the sulphur in the air would fire at the miners' candles, the flame run from one end to the other, with a thundering noise, making the earth shake, and in two moments the sulphur was spent, the fire extinguished of itself, and all clear again. The only shift the workmen have is to clap down on the earth instantly on their faces till it is over."

The explosions here recorded are undoubtedly similar to that at the Mill Close mine. At the latter mine, a hard, black, brittle variety of bitumen is of frequent occurrence.

Similarly, the fire-damp explosions that have occurred in salt mines are due to the presence of hydrocarbons produced by the decomposition of vegetable substances. The grey or blue colour so frequently met with in rock salt is due to the presence of bitumen. In several localities, notably at Stassfurt, in Prussian Saxony, and at Wieliczka, in Poland, the salt contains bubbles filled with various compressed gases (hydrogen, carbonic acid, and carbonic oxide), which, when the salt is dissolved, give rise to a crackling noise. Liquid inclusions in rock salt are extremely frequent. Some are visible to the naked eye, others are microscopic. The enclosed material is usually a hydrocarbon. According to J. N. Bremer,* combustible gas was evolved in large quantities from a fissure in the marl in the rock salt at the Sztatina mine, Marmaros county, Hungary, and was used for lighting the workings. At Gottesgabe, near Rheine, in Westphalia, the gas evolved was used in 1826 for lighting the workings, and even conducted through wooden pipes to the manager's house, and there used for lighting and for cooking purposes. Similar outbursts of gas were utilized at Zugo, near Klein Saros, in Transylvania; and at the Bex salt mines in the canton of Vaud, Switzerland, fire-damp has, according to Brunet,‡ been used for lighting the workings, being received from the fissures in sheet iron pipes. The gas probably comes from the enclosing limestones, which are possibly bituminous. It is a curious fact that the first fire-damp explosion recorded is shown by Professor F. Posepny,|| to have occurred at a salt mine at Hallstadt, in Austria, on September 9, 1664, twenty years before what is generally supposed to be the first historical evidence of the presence of fire-damp, given by Robert Plot,§ in 1684.

In iron mines, several explosions of fire-damp have been recorded. A. Daubrée¶ met with fire-damp in the mines of pisolitic iron ore at Gundershoffen and Winckel in Alsace. At Gundershoffen the pisolitic iron ore, which was worked up to 1825, occurs disseminated through a yellow clay overlying marls of Upper Liassic age. The ore-bed is covered by a greyish blue clay, some twenty yards in thickness. In the bed, numerous nodules of gypsum are met with, and the clay immediately above the deposit is impregnated with grains of iron pyrites. In the bed, which was worked in 1818 at a depth of 33 yards, insignificant gas explosions were of frequent occurrence. In 1824, however, a serious explosion occurred, by which a number of miners were seriously injured. The Winckel bed is deposited in a hollow in white limestones of Upper Jurassic age. The pisolitic iron ore is disseminated through a grey clay, and the whole is overlain by a limestone conglomerate. In 1832, an explosion occurred when some workings, that had been suspended for a time, were entered. Wooden planks were ejected from the shaft and thrown to a distance of 10 yards from the mouth, and the only workman in the mine at the time was badly burnt. An explosion of a less serious character occurred on June 27, 1846. At the end of a level, a great influx of water was observed, and in raising his light to see whence it proceeded, the captain ignited the gas, and was thrown violently to the ground and slightly burnt.

Castel** mentions an explosion of fire-damp which occurred on November 15, 1853, at the Voulte iron mine by which many miners were seriously burnt. The ore-bed at Voulte is enclosed in black marls of Middle Jurassic age, underlain by mica-schists in unconformable stratification. The gas was ignited by a spark from a miner's pick. In this case the presence of gas appears to be due to the existence of a gaseous lignite in the marl at a slight distance from the ore-bed. In mines working true fissure veins, numerous explosions have been recorded. In March, 1845, an explosion occurred in old workings that had not been entered for some years, at the now abandoned copper mine of Grand-Saint-Jean, near Giromagny, in Alsace. Gas has been noticed on several occasions at Pontpéan, in Brittany, where it is

*Poggendorff's Annalen der Physik und Chemie, vol. vii., 1826, p. 131.

†Gilbert's Annalen der Physik, vol. xxxvii., 1811, p. 1.

‡Comptes rendus mensuels de la société de l'industrie minière, 1882, p. 129.

§Oesterreichische Zeitschrift für Berg- und Hüttenwesen vol. xxxiii., 1885, p. 606.

||Natural History of Staffordshire.

¶Annales des mines, 4th series, volume xiv. 184, p. 33.

**Ibid., 5th series, vol. vi., 1854, p. 94.

*Nov. No. of Eng. Inst. of Mining and Mech. Engineers.

†Reports of the Inspectors of Mines for the year 1887, London 1888, p. 377.

‡General View of the Agriculture and Minerals of Derbyshire, London, 1811, p. 333.

§A View of the present state of Derbyshire, 1789, p. 174.

||The History of the Mineral Waters of Derbyshire, 1734, p. 96.

still occasionally met with.^{††} The vein consists of argenteriferous galena and blende, and traverses, in a north and south direction, the ancient clay-slate. As there is a dislocation that has brought a portion of the deposit to the level of the Tertiary strata, it is possible that the gas outbursts are due to the influence of lignite deposits, which may exist in these beds.

Charlton* reports the occurrence of inflammable gas in the copper pyrites deposit of Rocca Federighi, in Tuscany. In 1875, a timbered level that had been abandoned for two or three years was encountered by a cross-cut. On holing, large quantities of water were ejected, and, immediately afterwards, an explosion occurred by which three workmen were seriously burnt. Again, in 1877, at the same mines, an explosion occurred on opening an old adit level that had been abandoned for fifteen years. In this case a thin parting of rock separated the old level from that in which the men were working and matter having an unpleasant odour percolated through. A piece of the roof fell, and the captain, raising his lamp to see what was the extent of the disaster, exploded the gas, the three men in the level being very seriously burnt. From this description it appears that, under certain conditions, the decomposition of wood in water or in moist air may give rise to the formation of inflammable gas in exactly the same way as marsh gas is produced in stagnant pools. The explosions that have occurred in some of the Saxon mines when old workings were entered, may be explained in this way. The archives of the Royal Saxon Mining Bureau, quoted by Tittel,[‡] record several explosions of this kind. At the St. Johannes mine, at Rehhübel, in the Schwarzenberg district, a cross cut was driven from the Urbanus adit level, at a distance of 760 feet from the mouth of the adit. On March 11, 1872, two miners were working at the end of this cross-cut, and at noon a quantity of water burst through. At 3.45 p.m. an explosion of gas occurred. One of the miners, though badly burnt about the head, face and hands, found his way in the dark out of the adit and escaped. The dead body of the other miner was found at a distance of 643 feet from the mouth of the adit. It was subsequently found that the water from an old shaft accompanied by marsh gas, which had in all probability been formed from the decaying timbers, had burst through an aperture, and become ignited by the miners' lamps.

At the Churprinz Friedrich August mine, at Grossschirma, in 1859, a brick dam was put in to keep out the surface water. In 1882 the system of drainage was changed, and the dam was bored through in order to insert an iron pipe provided with a cock for letting off the water as required. While the boring was in progress water and gas burst through, and an explosion followed by which the miners engaged were seriously injured. Similarly, at the Alte Hoffnung mine at Schonborn, a dam built in 1868 was opened in 1870 in order to ascertain whether there was as much water as formerly. The gas issuing with the water, ignited, and the flame extended for 20 feet and burned for several seconds. Behind the dam, the level had been timbered for some 30 yards.

The presence of fire-damp in metalliferous mines cannot always be traced to the decomposition of timber under water. There was very little timber in the Winckel levels, and none at all in the Giromagny mine. In many mines, too, containing an enormous quantity of timber partially submerged, no trace of gas has been observed. This was the case at the Alter deutscher wilder Mann mine, near Grund, in the Upper Harz. This mine was under water for 200 years, and was visited by the writer in 1882, immediately after the water had been pumped out.

Another explanation must be sought for the presence of fire-damp in the Monte Catini mine in Tuscany, where in 1845 many miners lost their lives by an explosion, and in the celebrated Van mine near Llanidloes. The latter mine is the most productive lead mine in the United Kingdom. The vein occurs in rocks of Lower Silurian age. The occurrence of gas at this mine has been noted by Dr. C. Le Neve Foster.[‡] Fire-damp was found at the adit, and in nearly every level below while tapping or making the first drivages on the lode. The gas rushes out with the water, making a great noise, and always appearing to come from below. The miners regard it as a sure harbinger of lead ore. The quantity has sometimes been sufficient to cause slight explosions, by which miners have had their hair and beards singed. It is not improbable that sulphuretted hydrogen has also been emitted.

T. Macfarlane[§] describes the occurrence of fire damp in the Silver Islet mine, situated on a small rocky island

in Lake Superior. On December 28, 1875, while a party of miners were engaged in drilling a hole in the end of the drift at the 8th level, the drill suddenly broke into a crevice, from which water at once commenced to flow, but not in great quantity, and not being aware that it was accompanied by an emission of gas, one of the miners took a candle to look at the hole. The gas instantly took fire, sending out a flame of more than forty feet in length. The hole was subsequently stopped with a wooden plug, and when a lighted candle was applied to the imperfectly plugged hole, the gas again ignited, giving a jet of flame about a foot in length, which continued to burn for several weeks.

In these cases, it appears probable that the gas has been derived from beds beneath the ore-vein, from which it has ascended through fissures into the workings.

Sulphuretted hydrogen has, in many places, been engaged in sufficient quantity to become ignited. This occurred during the sinking of a well at Gajarine, near Conegliano, in Lombardy, and is described by L. E. F. Héricart de Thury.[†] The explosions described above cannot, however, be attributed to this cause, for if sufficient sulphuretted hydrogen had been present it would at once have been detected by its characteristic odour, and by the odour of the sulphurous acid formed on its combustion.

The oldest description of the occurrence of sulphuretted hydrogen in mines is given by A. A. Barba, the director of the mines at Potosi, in Peru, who in 1640 published a Spanish treatise on mining.[‡] The description, as given in the Earl of Sandwich's translation as follows:—

"Some do think that there is some matter in the bowels of the earth so stinking and abominable, that it doth correspond with the ordure of animals: the truth is, that there be places in the earth that instantly kill, with a pestilential smell. And setting aside the stories of this kind, both ancient and modern in remote countries, I shall relate two examples, where I myself was present, which was at the discovery of the rich country of San Christoval de los Lipos; at that time, in a beautiful high hill, that together with others encompass the dwelling of the miners, two Galleguares found a mine, which at first they called after their own names, but ever since, to this present, it is called from its effects, *The stinking Mine*. At first they got out of it very rich ore between white chalk; and as they began to sink deeper they were forced to give over by reason of a most abominable ill smell they met withal, which killed several of the miners, Indians; and so it lay unwrought for four or five years; after which time another miner (I being then in the country) undertook to proceed in the working of it; thinking that having lain so long after its first opening, the ill quality would have been evaporated; but that experiment cost the lives of two Indians more, whereupon they forebore the work, and have done so unto this day. The which I have not so much wondered at, as to see with my eyes the ground opened in several other parts of the mountain, at a great distance from the forementioned mine, and in digging scarce a yard deep, such a stink came out of the ground as forced the labourers to give over; and as I passed by those pits a few days after, I saw divers birds and serpents dead in them, having been intoxicated by that poisonous smell."

"In the famous country of mines, Verenguela de Pacages, in which the Indians procured a patent to dig, before that of Potosi was in use, because its veins were esteemed much richer than Potosi, and upon trial were found to be so; and the ore gotten there inferior to none in the Indies. In the hill of that country, called Santa Juanna, a miner followed a very rich and plentiful vein of silver, and intending to discover more of the like, he determined to break a hole into an old vault, and set two Indians upon the work, who after a few blows discovered a vacuity, out of which came so pestilential a stink, that killed the two Indians presently, and almost stifled others that were at a distance from them in the mine, who nevertheless ran out and told their master what had happened. He made haste to the mine, hoping to save the Indians, but at first entrance into the ground, upon the stairs by which they went down into the mine, he fell down dead, and his body remained there, nobody daring to go down to take it away to bury it."

In these cases, the gas was probably produced from the decomposition of pyrites ores. This decomposition may be detected in many old mines. The writer has observed the presence of large quantities of sulphuretted hydrogen in abandoned workings at the Rammelsberg mine in the Harz, at the Falun mine in Sweden, and at several of the Hungarian mines. In other cases, the acid waters produced by the oxidation of pyrites act on limestone and produce carbonic acid. Emanations of carbonic acid in the iron ore mines of the Upper Erzgebirge are described by H. Müller.* Similar outbursts have been observed at the mines of Massa Maritima, in

Tuscany, where a thick vein of pyrites and quartz traverses clay slate enclosing limestone beds. The hanging wall of the vein is formed by a band of clay that conducts a quantity of water into the workings, and serves as a receptacle for gas, principally carbonic acid, probably produced in the manner indicated. A similar reaction may have produced the large quantities of carbonic acid given off from crevices in the south wall of the lode at the Foxdale lead mines in the Isle of Man. In 1883, when the writer visited these mines, the amount of gas given off at the eastern end of the 185 fathom level was so great that, notwithstanding the large volumes of compressed air continually forced in from two air pipes, candles would not burn and the work was carried on under great difficulties.

In the same way, carbonic acid was met with in 1875 in the Johann Stehenden vein, in the Himmelsfurst mine, at Freiburg, in Saxony. Here, too, lights would not burn before a freshly opened cavity.

Carbonic acid, produced by the action of acid waters on limestone, is of not unfrequent occurrence in the Derbyshire lead mines. At a mine near Voulgreave, the writer has seen this gas being raised in buckets attached to a windlass. An early account of the occurrence of carbonic acid is given by William Hooson, a Derbyshire miner, in a quaint work* published in 1747. The effect of the gas on the miners is described in the following terms:

"All miners both ancient and modern give this account, that they never feel any sensible pain or disorder, but after a most pleasant way, it takes the whole use of all their limbs, and they settle down, as a man falling asleep, feeling nothing at all, but an extraordinary sweet and luscious taste and smell, that beguiles and ravishes the senses in a moment."

"This is the whole account that we the miners can give of it; and this so far as the memory continues, after being seased or tapished with it, and being drawn up by the heels for dead, yet have recovered; but never could such men remember, or give any account of the least pain they ever felt in it. And now give me leave to tell you the best preservative we miners know of, and verily think is of great force against it, we have it delivered to us by the old miners, and many I have known to confirm the same; but here are two examples, the first I was not present at, being more than two miles from where I then was; the other in our Liberty, and my brother one of them, the former was thus: Two miners sinking a shaft in hard shale near 20 yards deep, it happened the ground-damp bred in it; one of them went down, his partner of a considerable time after hearing nothing of him, and knowing it was windless, began to suspect the matter, and forthwith calls his next neighbours, and tells them what he feared; having now some company, down he goes to see what the matter was, and soon was damped likewise; and now more company coming in, one young bold man ventures down and has the same fate; and after him (the depth of the shaft being so small) two more, and those damped likewise; this put the whole company to a stand, and as they were considering to carry wind down in trunks, by chance a tinker seeing a crowd of people, turns out of his way to see what was a doing there; having heard the matter, he said it was no difficulty to fetch them up; (the man had been drinking all night, he feared no danger, nor could any persuasions stay him from his design) he throws by his budget and pulls off his coat, and down he goes, ties the dead men in the rope one by one by the heels, and after climbs up himself, without any damage, only when he came up again into the fresh air, he vomited most violently, and was most deadly sick; therefore it was concluded that the fumes and strength of the ale preserved him, according to the old miners' opinions."

In the second case described, an old miner ties the bodies of three miners, suffocated by the gas, to the rope, and finally comes up himself. "This man," writes Hooson, "had been drinking all the day before, and most part of the night, so that it should seem not to work so soon upon a man well steeped in ale. Many men's lives have been saved after this manner, which seems to be an act of Providence rather than any foresight, or care that a man has of himself, and indeed I never yet knew nor heard of any man that was sober, durst be so bold to take a sufficient dose of ale on purpose that he might the better encounter it."

SUMMARY.

From the various records collected in this paper, it is believed that there is sufficient evidence to show that the gas outbursts, that have been observed in metalliferous mines, are not all due to the same cause, and may be explained by the following hypotheses:—

1. The decomposition of timber in a mine, in a similar manner to the decomposition of vegetable matter in marshes, may produce fire-damp which would accumulate in cavities that are ultimately broken into. This is evidently the explanation of the explosions in the Saxon

^{††}Rapport de M. Haton de la Goupillière au nom de la commission d'étude des moyens propres à prévenir les explosions du grison, Paris, 1880, p. 39.

*Comptes rendus mensuels de la société de l'industrie minière, 1879, p. 6.

[†]Berg. und Hüttenmännische Zeitung, 1882, p. 226.

[‡]Transactions of the Royal Geological Society of Cornwall, vol. x., 1879, p. 33.

[§]Transactions of the American Institute of Mining Engineers, vol. viii., 1880, p. 226.

[†]Annales des mines 3rd series, vol. iv., 1833, p. 515.

[‡]Art de los metales, Madrid 1640.

[§]The Art of Mettills, London, 1670.

*Gangstudien, vol. ii., p. 502.

*The Miner's Dictionary, explaining not only the terms used by miners, but also containing the theory and practice of that most useful art of mining, more especially of lead mines. Wrexham, 1747.

mines, and in the Rocca Federighi mine.

2. In iron mines, where the iron is not entirely in the state of peroxide, water might be slowly decomposed, and hydrogen be produced. This, if the ventilation of the mine was defective, would accumulate in the upper portions of the underground excavations. This is a possible explanation of the explosions at Gundershoffen and Winckel.

3. In these cases, however, it is more probable that the gas was fire-damp, which emanated from beds beneath the ore deposit, and found its way, through fissures, into the workings. The gas would thus be produced in the same way as the natural gas of the United States, China, and other countries, where it is given off from rocks of varied age enclosing bitumen. The Upper Liasic marls on which the Gundershoffen deposit rests are often sufficiently bituminous to enable them to be burnt. At Winckel, however, no such beds are met with below the deposit, though they occur in the Jurassic rocks of the vicinity. The same explanation is therefore feasible. At the Mill Close, and other mines in Derbyshire the gas is derived from the Yoredale Shales, which are undoubtedly of a bituminous character. Bituminous matter has occasionally been found in mineral veins, and would appear to have been derived from the adjacent rock at the time of the filling of the vein fissures. In the Snailbeach lead mine in Shropshire, small nests of bitumen abound in the vein, and the writer has found the same substance in geodes in some of the abandoned metalliferous mines of Alsace, near Mollau and St. Amarin, in the Vosges. The explosions at Monte Catini, Silver Islet, and the Van mines would appear to be due to natural gas derived from adjacent rocks.

4. Fire-damp may be produced from the decomposition of organic matter, in the same way as the hydrocarbons met with in salt mines. At Pontepan, and at the Voulte mine, the fire-damp was apparently derived from beds of lignite in the vicinity.

5. Explosions have in some cases been caused by outbursts of sulphuretted hydrogen, produced by the action of acid waters on pyrites ore.

6. The outbursts of carbonic acid met with at Foxdale, Freiberg, and Massa Maritima, may have been caused by the action of acid waters, produced by the oxidation of pyrites, on limestone or metalliferous carbonates.

The Quarter's Yield from Nova Scotia Gold Mines, as per Official Returns.

DISTRICT.	ROCK CRUSHED.	GOLD YIELD.
	Tons. Cwts.	Ozs. Dwts. Grs.
SHERBROOKE—		
January.....	281 ..	83 13 ..
February.....	150 ..	73
March.....	.. ..	.. .. ..
Total.....	431 ..	156 13 ..
SALMON RIVER—		
January.....	650 ..	181
February.....	500 ..	160
March.....	400 ..	173 10 ..
Total.....	1550 ..	514 10 ..
LAKE CATCHA—		
January.....	94 10	103
February.....	96 86	10
March.....	170 131	5
Total.....	371 7	118
WHITEBURN—		
January.....	175 ..	115 7 2
February.....	35 ..	52 2 3
March.....	103 ..	91 19 16
Total.....	313 ..	259 8 21
CARIBOU—		
January.....	551 4	122 17 14
February.....	369 7	98 8 16
March.....	243 3	63 6 ..
Total.....	1163 14	284 12 6
UNIACKE DISTRICT—		
January.....	177 ..	92 5 2
February.....	220 ..	175 17 15
March.....	260 ..	104 1 ..
Total.....	657 ..	372 3 17

NOVA SCOTIA GOLD QUARTZ YIELD.—(Continued).

DISTRICT.	ROCK CRUSHED.	GOLD YIELD.
	Tons. Cwts.	Ozs. Dwts. Grs.
MALAGA—		
January.....	314 ..	276
February.....	520 ..	302
March.....	.. ..	.. .. ..
Total.....	834 ..	578
CENTRAL RAWDON—		
January.....	175 ..	177
February.....	.. ..	.. .. ..
March.....	110 ..	95
Total.....	285 ..	272
MONTAGUE—		
January.....	120 ..	362 5 ..
February.....	76 ..	140 11 ..
March.....	.. ..	.. .. ..
Total.....	196 ..	503 6 ..
RENFREW—		
January.....	233 ..	64 9 ..
February.....	.. ..	.. .. ..
March.....	21 10	23 18 ..
Total.....	254 10	88 7 ..
LEIPSIGATE—		
January.....	.. ..	.. .. ..
February.....	15 ..	25 15 14
March.....	10 8	4 9 20
Total.....	25 8	30 5 10
WINE HARBOR—		
January.....	98 10	50 16 ..
February.....	60 ..	18 1 ..
March.....	.. ..	.. .. ..
Total.....	158 10	68 17 ..
OLDHAM—		
January.....	67 12	155 7 ..
February.....	77 18	52 10 19
March.....	91 10	133 7 ..
Total.....	237 ..	341 4 19
MOOSE HEAD—		
January.....	.. ..	.. .. ..
February.....	.. ..	.. .. ..
March.....	80 ..	2 10 ..
Total.....	80 ..	2 10 ..
GOLD RIVER—		
January.....	.. ..	.. .. ..
February.....	.. ..	.. .. ..
March.....	100 ..	40
Total.....	100 ..	40
BROOKFIELD—		
January.....	326 ..	192 3 ..
February.....	.. ..	.. .. ..
March.....	.. ..	.. .. ..
Total.....	326 ..	192 3 ..
15 MILE STREAM—		
January.....	120 ..	63
February.....	168 ..	116 15 ..
March.....	175 ..	127 10 ..
Total.....	463 ..	307 5 ..
STORMONT—		
January.....	199 ..	109 8 ..
February.....	257 ..	138 3 ..
March.....	255 ..	134 10 ..
Total.....	711 ..	382 1 ..

Facilities in the Engine-Room.—Owners of buildings and machinery are, frequently, thoughtless respecting the requirements in an engine-room. However costly the plant, however carefully erected, however elaborate in detail and perfect in finish, however intelli-

gent and skillful the engineer, there will always be occasions when something in the repairs, adjustment or alteration will have to be done and done quickly. Just then it is no time to cast about for tools and appliances. These should be on the premises. We have heard complaints from many engineers about the parsimoniousness of their employers when tools, materials, stores and appliances were highly necessary in the engine and machinery department. Those corporations and wealthy mill-owners who practice extreme parsimoniousness and an impolitic policy in the care of their machinery plants, act upon a penny wise and pound foolish system which is discreditable to modern engineering. Repairs are often done promptly and well at little expense by an engineer and his fireman when the appliances and materials are at hand. No engine-room should be without its vise, bench, and drawer full of files, chisels, taps, dies and drills. Give engineers a chance to save money for their employers by a constant use of machinists' hand-tools, and, where circumstances permit, to keep their engines and engine-rooms in the neatest and cleanest manner possible. A noisy engine and a slovenly engine-room indicate that there is more than one screw loose somewhere.

Four Big Boilers Made in Canada.—The Polson Iron Works Company, of Toronto, 28th ult., shipped to Owen Sound the last of four large boilers constructed by them for the car ferry they are now building at their shipyard there for the Canadian Pacific Railway Company. These boilers are the largest ever made in Canada, and also the largest ever carried by rail on this continent. They are of the cylindrical return multitubular type, and are 13 feet 3 inches in diameter and 14 feet long, weighing 37 tons each. The shell-plates are 11-16 of an inch in thickness, and were specially rolled in Scotland. The tubes are of German manufacture, and are 4 inches in diameter, 11 feet long, and 148 in number. There are in each boiler three of Fox's corrugated furnaces, 42 inches in diameter and 10 feet 11 inches long. The Government test showed an allowance of 94 pounds working-pressure. The riveting of these boilers was done by a Tweddell hydraulic riveter, with a gap of 8 feet 4 inches, lately erected in the company's shops. The boilers, when completed, were lifted bodily on to the cars by a large overhead traveling crane, which has a lifting capacity of 50 tons.

A Great Steel Plant's Record.—The union of several rolling-mills and steel works into the Illinois Steel Works, which was effected last year, illustrates once more the advantage of joining conflicting or mutual interests. The following splendid showing is the immediate result: The total value of finished products shipped in the eight months of 1889 after its organization was \$15,275,529. The company received a total of 2,048,688 tons of raw material, and shipped over half a million tons of finished products. The total pay roll amounted to \$3,660,888, and the purchase of miscellaneous stores and supplies of all kinds amounted to \$693,000. The company received 88,554 cars of material, and shipped 40,954 cars. There were employed directly at all the works on an average per day, 8,360 men, besides the employment given indirectly to a large additional force in the production of coke, coal, iron ore, limestone and other materials.

The Decreasing Cost of Aluminum.—Aluminum, one of the most valuable and useful metals, and at the same time one of the most plentiful in its crude state, is now being produced, by different processes, at a comparatively low price. When the metal was first shown in Paris, by Denille, in 1855, it was priced at \$15 per ounce. In 1857 it was sold at \$2 per ounce, and in 1884 its production had been so cheapened that the metal for the tip of the Washington monument was bought for \$15 per pound. At the close of last year it was for sale at \$4 per pound, and developments are now being made which still further reduce its cost. There are few of the metals that are of such intrinsic value, or that can be put to such a variety of uses as aluminum, and if its production can be cheapened to correspond with that of other metals, it will become one of the most extensively used and easily obtained articles of manufacture.

Graphite as a Blast Furnace Lining.—An experiment was tried at the Crown Point Iron Co.'s plant, some time ago, on the occasion of their relining and starting in blast one of their large furnaces. After the fire-brick were in place, a cheap article of graphite or plumbago was bought, reduced to a paste with water, and the interior of the furnace washed with the plumbago paste. It gave a slippery glaze—incident to the lubricating quality of the plumbago—to the fire-brick lining, which lessened the time necessary to a heat quite a percentage. The slippery surface refused to be coated with slag or other refuse, and the charge passed down in less time and left the lining free and clear. The Crown Point managers claim quite a success for their scheme. The expense of the trial was very small compared with the value of the result.

Iron Ore in British Columbia.

In one of his recent reports Dr. G. M. Dawson states that most of the ores hitherto discovered are magnetites, which occur in association with the older metamorphic rocks of the province. Clay ironstone, however, is of frequent occurrence in the coal series of Vancouver and Queen Charlotte Island, as well as in the tertiary rocks of the interior. The only iron ore deposits which have yet been worked are those of the south-west side of Texada Island, the largest exposures of ore occurring about three miles north-west of Gillies Bay. Here the ore mass is from 20 to 25 feet in thickness. It constitutes an irregular contact deposit between limestone and granite. The ore is magnetite of excellent quality, containing nearly 70 per cent. of iron.

At the principal deposit of the ore a wharf has been built. The ore is brought down from the quarry to the wharf by an incline, the height of the quarry above sea level being 250 feet, and the length of the incline $\frac{1}{4}$ mile. The shipments in 1885 amounted to 190 tons; in 1888 the quantity shipped was 7,300 tons, valued at £3,680. Magnetite is also found at the Queen Charlotte Island, the ore being, as a rule, very pure, and exceptionally good specimen yielding on assay 69.88 per cent. of iron. Very pure ore containing 71.57 per cent. of iron was also found at an island in the Walker Group, Queen Charlotte Sound. Other deposits exist at Sooke Harbour, Vancouver's Island, and at a number of other places.

Persia: A Probable Field for Mine Managers and Mining Engineers.

Colliery Manager.

Manufacturers and factors in other industries are anxiously looking about for new markets; capitalists are everywhere in search of new countries in which they may more profitably use their means than in our own, and the rapid increase in our population causes thousands to sigh for, if not to look for, fresh fields of labor in which the number of workers shall not be so disproportionate to the work to be done. The reason for this state of things is that all our professions, trades, and occupations are sadly overmanned. In the industry we represent it is too painfully true that of those who have lately obtained, or who are now studying for, colliery managers' certificates of competency, the number who can secure satisfactory appointments at home will be comparatively limited.

These and other like considerations have invested the recent meeting of the Imperial Bank of Persia with great interest. Persia appears to be likely to furnish a fruitful field for our capitalists, manufacturers, and employees of every character and of almost every grade. It is not so much as a bank as in its capacity of a State institution that the Imperial Bank is likely to contribute to the commercial prosperity of Persia, and at the same time to assist in the development of mutually advantageous commercial relations between the Persian empire and Great Britain. The concessions possessed by the corporation are of a most comprehensive character. It has been granted the exclusive right of working throughout the empire the iron, copper, coal, lead, asbestos, and all other mines, which belong to the State and have not already been conceded to others. The corporation has thus virtually obtained the sole privilege of getting minerals in Persia, for all mines are State property, and the concessions made to others are few and insignificant.

These large concessions may be regarded as the most important part of the bank's charter, and while they are sure to be a source of considerable profit, they are also calculated to infuse a spirit of commercial enterprise and business activity throughout the empire. Fully alive to the requirements of the vast territory through which they have to deal, the board are now considering a road and transport service concession, which will require the formation of a company of an international character for its construction and management, and from which the bank will reap important direct advantages. This question of road making—especially the construction of a serviceable roadway from Teheran to the river Karun—is of the first importance, and is properly being dealt with at once, and affords an opening for the employment of a large amount of imported skillful aid. But the point to which we desire to call the attention of our readers is the development of the vast mineral wealth of the empire. The directors of the Imperial Bank, upon whom this development now devolves, have the assistance of General Houtum-Schindler, a mining engineer of considerable experience, and who has long been employed by the Shah. He has reported that coal is very abundant, and that there are many places in which it can be economically worked. It is, in fact, already being mined in the neighbourhood of Teheran, and the returns are said to be good, although the arrangements and appliances are of a very indifferent character. Many causes, some of

them local, are likely to render a native supply of coal most useful, and consequently very profitable. It has already been found necessary to import fuel from India, so that the mining of coal will be of immediate advantage. It is also within the range of possibility that the development of the coal deposits in the locality of Bushire will provide supplies for steamers calling there. Coal for that station is now sent from Great Britain. The importance of coal production on a large scale will be understood when it is remembered that there are, according to recent reports, prolific veins of copper, iron and lead. Copper smelting is carried on now, but with such imperfect apparatus that plates are imported on a large scale. A large supply of coal will induce extended and improved smelting operations. The getting of coal abundantly and economically must be a first consideration where it is so essential for the successful treatment of the numerous other minerals which abound. There is a bright future for the Persian empire if coal deposits and iron ores are found in such convenient juxtaposition as is reported.

The Imperial Bank will not—indeed, we think we are right in saying it cannot, according to its constitution—undertake the development of mines on its own account. It is certain, however, that it will speedily concede the right to do so to some other body, and there will, we think, be an opportunity for many mining engineers and colliery managers to obtain advantageous engagements in Persia, who may have to wait many years before any come within their reach in Britain.

Loadstone in Sweden.—In the western portion of the Timansberg mining field has been found magnetite exhibiting the unusual property of attracting magnetism, fragments some 132 lbs. in weight being able to support a needle $2\frac{1}{2}$ inches in length.

Removal of the Tariff on Imports of Mining Machinery.—In the present state of the industry the best possible machinery should be got with the least restriction possible, and the Government has decided to allow the importation, duty free for three years and no longer, of such mining machinery as is not made in Canada at the time of importation.

The Treatment of Wire Ropes.—"Under this head" writes T. H. Deakin, "I would call attention to the fact that rope manufacturers pay a high rate of railway carriage, to ensure the rope being kept dry and conveyed with care to its destination. It is equally necessary that in arriving at the colliery it should be stored in a house where it will be kept perfectly free from wet, steam, and noxious fumes. I have heard of a rope suddenly breaking after being in work but a short time, and when there appeared to be no apparent reason for the failure, unless it be that it was kept at the colliery stores for a long time prior to its being put to work. If ropes are kept in stock any length of time, they should be in the dry and turned over and oiled from time to time with a good and pure oil, to insure them against rust. When wanted for work, the rope should be placed on a turn-table or reel so that it may be uncoiled. If treated in any other way the strands are certain to be more or less opened, and there is great risk of damage to the rope by kinking; and if a slight kink is once made, that portion of it is irretrievably damaged. The rope having been kept free from rust while in the stores, it is important to keep it so as far as possible whilst in use. This can best be done by making up a thick oil, and as the rope is being wound slowly on the drum, and before it becomes wetted, this mixture should be applied, and care taken to work it well into the crevices of the rope, so that it has the appearance of a solid bar. Ordinary rope oil should then be applied for a few days consecutively, and afterwards, under ordinary conditions, an oiling once a week will keep it in good order. If this course be adopted, it will be found to add immensely to the life of the rope. Some people object to having the ropes greased, because they say broken wires cannot be detected; but I, for one do not subscribe to this doctrine. Ropes, will of course, stretch considerably on being first put to work, and for a time the engineman should be careful to start gently, so as to feel the load, before putting on much strain."

Failure of Steel Flat Cars.—The Cleveland, Akron & Columbus Railroad recently ordered five hundred coal cars for that line, and the first cars were delivered last fall. The cars are quite handsome in construction and captivate at sight. Some years ago an attempt was made to build iron cars, but they went to pieces so much quicker than wooden cars that the manufacturers were obliged to discontinue their construction. The builders of these new coal cars believe they have surmounted obstacles in the way, and have placed trusses and braces at every conceivable point to give the cars strength. The trusses and supports give them the appearance of an iron bridge. It seems, however, that there is a difference between an all iron bridge on wheels and an all iron

bridge which remains stationary. It is now only about four months since these new cars were placed on the road, and the car inspector, Mr. Chrisman, reports that they require constant repairing. The truss-rods are shearing and the nuts falling off on every trip. The average life of a wooden coal car is about seven years, but these new cars will not last half as long with constant repairing. This seems to settle the question whether all steel can take the place of a combination of wood and steel and iron in cars, waggons or harvesting machines.

The Proper Care of Boilers.—To clean the boiler, remove all the covers of the manholes; scrape, or if there is much hard incrustation, chip the interior surface, thoroughly loosening and removing all sediment and dirt. Pass a quantity of clean water through the manhole. Examine and clean all feed-water and other pipes periodically; remove and scrape fusible plug, and renew if necessary. Keep all flues or tubes thoroughly clean and free from soot, &c. Examine all cocks and fittings, and see that they are in order and free from leakage. Examine the flues and see that the boiler seatings are dry, and that there is no leakage either from the seams or from the roof. Tubular boiler tubes should be swept once a day, or twice if the fuel be bad. This can be readily done with a jet of steam.

Production of the Victoria Gold Field.—The Victoria gold field up to the present time had produced 64,000,000 ounces through a period of thirty-eight years, chiefly alluvial gold—but the quartz reefs promise to yield gold profitably for more than a hundred years, reports the Government geologist who is of the belief that the quartz mines may be worked profitably to 2,000 feet and made to supply at least as much gold in the future as the placers have done in the past. It is not generally known, we fancy, that the largest single silver mining property in the world at this time is the Broken Hill Proprietary Company's property in Queensland, upon upon which more than 800 men are employed underground alone. A vast quantity of ore is exposed. Some of the lodes, kaolin carrying silver, are 230 feet wide. There is every indication that untried ground owned by the company will prove equally rich with any as yet worked. Thousands of tons of ore are ready for the ore-dressing mills before being sent to the smelters. At some points are large bodies of massive lead ore that does not require dressing. Carbonates and galena abound, there are also seams of native copper met with. The underground openings are enormous.

Life Preserver for Miners.—Mr. A. Upward, an Englishman, has invented an apparatus for ascertaining the contiguity of water or gas to workings in mines and for passing food to imprisoned miners and for rescuing them. *The Colliery Guardian* thus describes the invention:—"The apparatus for ascertaining the state of a mine as regards approaching danger is firmly held to the face of the coal by means of struts and a piece of timber fixed vertically to the rear between the roof and the floor of a mine. It consists of a chamber fitted with a slide valve, which can be opened and closed at pleasure. Through a stuffing-box in the chamber on the working side passes a boring tool, with which the miner drills a hole in the coal to the distance inwards to which he intends to work. Assuming this to be, say eight feet, when he has reached that distance he withdraws the boring tool, and if neither gas nor water has made its appearance he knows he can safely work so far in. Should he tap water or gas during the boring there would be an inrush of the one or the other into the chamber of the apparatus, and its presence would be indicated by a pressure gauge. The boring tool would then be withdrawn as far as the stuffing-box, the safety valve would be closed in front of it, and steps would be taken to ensure safety in the workings. It is proposed by Mr. Upward that the detector should be used each day when the men proceed to their work, in order to ascertain whether or not the elements of danger are present, and only waiting the stroke of a pick to be released. The further modifications of this apparatus relate to the passing of food to imprisoned miners and to their bodily delivery. The apparatus in each case is similar in principle to that already described, but much larger. By means of the first a large hole is drilled through the coal, the drill is withdrawn and a tubular vessel containing food and messages is passed through. By the second a larger hole is bored and a larger tubular chamber passed through, into which the imprisoned men can creep, and thus be rescued one after another. Mr. Upward proposes that a testing apparatus should be kept at every colliery, and that depots should be formed in the different mining districts where relief and rescue apparatus should be deposited, and from whence they could be rapidly forwarded to any spot when required. These depots are to be furnished with medical and surgical appliances adapted for mining casualties, and with such stores as experience of the district suggests as being the most useful in cases of mining accidents."

The Enormous Strength of the Forth Bridge.—As showing the immense size and strength of the Forth bridge, in Scotland, a prominent English engineer has made a contrast in the following simple terms: As a grenadier guardsman, put at the average height of 5 feet 10½ inches, is to a new-born infant, about 19.34 inches, so is the Forth bridge to the largest railway bridge yet built in this country. To give an idea of the material used in the construction of the bridge, it may be mentioned that it included about 51,000 tons of steel, of two qualities—one to resist tensile and the other compressive strains, having strengths, respectively, of 30 to 33 and 34 to 37 tons per square inch of tension—and, as we stated before, upwards of 21,000 tons of cement, 707,000 cubic feet of granite, 117,000 feet of masonry and concrete for the foundations and piers, while 1,000,000 cubic feet of timber were used for temporary purposes. As many as 3,800 men were employed at one time in the construction. The stability of the bridge is assured, as far as human foresight can make it, and this will be apparent when it is mentioned that Mr. Baker, one of the engineers for the work, considers that half-a-dozen ironclads could be hung from the cantilever ends. Experts stated that the gale to which the Tay bridge succumbed did not give a higher pressure than 30 lbs. per square foot. In the case of the Forth bridge, a pressure of 56 lbs. per square foot has been allowed for acting over the whole surface—greater than ever has been experienced in this country. As to the cost, it is estimated that £2,250,000 has been spent on the bridge and the north and south railway approaches, but, including the construction of various connecting lines, nearly £3,000,000 (say \$15,000,000) will have been consumed.

FOR SALE DYNAMO AND ENGINE

One 6 h.p. Engine No. 1099, manufactured by E. Leonard and Sons.

One 25-hamp Dynamo.

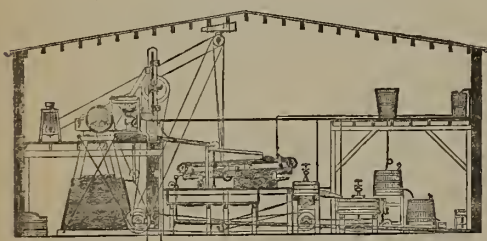
Above machinery having never been in use is entirely new. For particulars apply to

A. B. C.

Mining Review, Ottawa.

Charles M. Rolker, — LESSEE, — New York Ore Milling & Testing WORKS.

Office, -- 18 Broadway, New York.



Cable Address:—PHAPTRY, New York.

Consulting Mining Engineer.

Examinations made and reports rendered of mines and mining property, metallurgical works and pro.

Ores can be practically tested by any known process and the necessary plan of reduction determined. Works are complete in every respect for practical testing of Gold, Silver and Concentrating Ores and Tailings. ANALYSIS of ores and furnace products, etc.



MONEY ORDERS.

MONEY ORDERS may be obtained at any Money Order Office in Canada, payable in the Dominion and Newfoundland; also in the United States, the United Kingdom, France, Germany, Austria, Hungary, Italy, Belgium, Switzerland, Portugal, Sweden, Norway, Denmark, the Netherlands, India, Japan, the Australian Colonies, and other countries and British Colonies generally.

On Money Orders payable within Canada the commission is as follows:

If not exceeding \$4.....	2c.
Over \$4, not exceeding \$10.....	5c.
" 10, " " 20.....	10c.
" 20, " " 40.....	20c.
" 40, " " 60.....	30c.
" 60, " " 80.....	40c.
" 80, " " 100.....	50c.

On Money Orders payable abroad the commission is:

If not exceeding \$10.....	10c.
Over \$10, not exceeding \$20.....	20c.
" 20, " " 30.....	30c.
" 30, " " 40.....	40c.
" 40, " " 50.....	50c.

For further information see OFFICIAL POSTAL GUIDE.

Post Office Department, Ottawa.
1st November, 1899

LEDOUX & COMPANY, 10 CEDAR ST., NEW YORK, Engineers, Metallurgists & Assayers.

Public Ore Sampling & Storage Works

All the principal buyers of furnace materials in the world purchase and pay cash against our certificates of assay, through New York banks.

By special permission of the Secretary of the Treasury of the United States, cars of ore or copper matte passing through in bond can be opened and sampled at our works.

Consignments received and sold to highest bidder. Send for circular giving full particulars.

Mines examined and sampled. Assays and Analyses of all kinds.

Standard Powder Company

MANUFACTURERS OF ALL KINDS OF

GLYCERINE EXPLOSIVES

—FOR—

MINING

—AND—

RAILROAD WORK.

ADDRESS—

W. H. HARRISON,

MANAGER,

BROCKVILLE, ONT.

NATIONAL COLONIZATION

Lottery!

UNDER THE PATRONAGE OF

THE REV. FATHER LABELLE.

Established in 1884 under the Act of Quebec, 31 Vict.,

Chap. 36, for the benefit of the Diocesan Societies of Colonization of the Province of Quebec.

CLASS D.

DRAWINGS ON THIRD WEDNESDAY IN EVERY MONTH AT 2 P.M.

Prizes value \$50,000

Capital Prize: 1 Real Estate worth \$5,000.

LIST OF PRIZES.

1 Real Estate worth	\$5,000	\$5,000
1 Real Estate worth	2,000	2,000
1 Real Estate worth	1,000	1,000
4 Real Estates	500	2,000
10 Real Estates	300	3,000
30 Furniture Sets	200	6,000
60 Furniture Sets	100	6,000
200 Gold Watches	50	10,000
1000 Silver Watches	10	10,000
1000 Toilet Sets	5	5,000

2307 Prizes worth..... \$50,000

Tickets, \$1.00!

Offers are made to all winners to pay their prizes cash less a commission of 10 p. c. Winners' names not published unless specially authorized.

S. E. LEFEBVRE, Secretary

Office: 19 St. James St., Montreal, Can.



TENDERS.

SEALED TENDERS marked "For Mounted Police Provisions and Light Supplies," and addressed to the Honourable the Minister of Railways and Canals, Ottawa, will be received up to noon on Tuesday, 3rd June, 1899.

Printed forms of tender, containing full information as to the articles and approximate quantities required, may be had on application at any of the Mounted Police Posts in the North-West, or at the office of the undersigned.

No tender will be received unless made on such printed forms.

The lowest or any tender not necessarily accepted.

Each tender must be accompanied by an accepted Canadian bank cheque for an amount equal to ten per cent. of the total value of the articles tendered for, which will be forfeited if the party declines to enter into a contract when called upon to do so, or if he fails to complete the service contracted for. If the tender be not accepted the cheque will be returned.

No payment will be made to newspapers inserting this advertisement without authority having been first obtained.

FRED. WHITE,

Comptroller, N. W. M. Police

Ottawa, April 22nd, 1899.

ALL KINDS OF

RUBBER GOODS for MINING PURPOSES

MANUFACTURED BY

THE CUTTA PERCHA AND RUBBER MFG. CO. OF TORONTO, 43 YONGE STREET, TORONTO.

Steam & Air Hose, Rubber Bumpers and Springs, Fire Hose, Pulley Covering, Rubber Clothing & Boots.

The Canadian Mining Review

CONDUCTED BY B. T. A. BELL

OFFICES:

UNION CHAMBERS, 14 METCALFE ST.,
OTTAWA.

Vol. IX.

MAY, 1890.

No. 5.

WANTED.

Any of our readers having spare copies of January, February and March issues of the Review for this year, will confer a favor by returning them to this office.

Mining Legislation in Nova Scotia.

During the session of the local parliament just closed, several enactments were passed of a character to interest the miners. No State or Province on this side of the Atlantic has paid as much attention to the education of the coal miners as Nova Scotia. The limited resources available for this purpose have been carefully expended. This year the Board of Examiners for candidates for certificates as underground managers has been re-organised. It is to consist of the Chief Inspector and nine persons conversant with coal mining, three Mining Engineers, three Colliery Managers and three Colliers. The Province is divided into three Districts for examination purposes. The papers of the candidates are forwarded for a general meeting of the Board when the proper certificates are granted. There are at present in the different mining localities, nine instructors engaged in preparing candidates for the examinations. There is no fee paid by the pupils. The rooms, light, etc., are furnished by the Government, and the instructors are paid a fee for each candidate passing successfully.

The course of instruction comprises surveying, ventilation, mine management, methods of working, etc., and no restriction is placed on the attendance of young men who are under age, but are anxious to improve themselves in the higher walks of their calling. These schools of instruction are peripatetic so that in rotation they visit every locality where pupils may offer.

It was to be expected that in the case of coal miners, who are obliged to work at an early age, there would be many who were qualified by experience although deficient in familiarity with the rudiments of scholarship, and the principles under-lying the practice of mining. As this became apparent from the reports of the Board of Examiners and the Instructors, a further step was decided on, and during the session of this year, legislation was passed to the following effect:—

First.—That in any community where there are twenty-five or more persons of the age of fifteen years and upwards, wishing instruction in the ordinary branches of an English education, night schools may be established for their benefit.

Second.—That the Council of Public Instruction shall provide licensed teachers who shall be paid such salaries as are deemed adequate.

This legislation, although couched in general terms, applies more especially to those communities where the younger members are obliged to work at an early age, and are deprived of the educational facilities extended to their more fortunate brothers. And by its means it is hoped that cities, industrial and mining localities will be benefitted.

The Coal Mines Arbitration Act passed last session, having proved on trial to be in some important respects couched in ambiguous language has been repealed, and re-enacted. The principle remains substantially as before, that a majority of the employed must be desirous of arbitration before its provisions can be put in force. That a preliminary hearing must be had before the Commissioner of Mines who is to decide if there be *prima facie* evidence warranting a reference to the tribunal of arbitration or not. The Board of Arbitration consists of five persons, two permanent members appointed by the Government, one from the employers, one from the employed, and a fifth appointed jointly by the last two. The Act contains provisions for retention of wages, and for a deposit of an equivalent amount by the employer pending a decision of the Board. Proceedings under the Act cannot be removed by *certiorari* or otherwise into any court of record, and an appeal lies only to the Supreme Court in *banco*. The provisions of the Act appear to be drawn in favor of the employed, but presumably the great difficulty will be found in any attempt of the Board to decide what constitutes a financial condition of any company to warrant either an increase or lessening of wages when the rates paid are about the average.

During the passage of the bill through the local legislature, a measure having the same object in view was introduced in the Imperial Parliament, but its chances of passing are considered doubtful.

The gold mining areas in Nova Scotia are composed of multiples of areas 250 by 150 feet, and as errors are sometimes committed by surveyors, which give rise to disputes, and loss of mining ground, it has been sought to regulate this by requiring the adjoining lessees to be present in person or by agent during any survey ordered by the department. If no objection is raised when the representatives of all interested properties are present at the survey, the lines then laid down are to be taken as fixed. If any are absent through unavoidable cause, the survey can be repeated on the applicant, one of the interested parties, depositing with the commissioner a sum equal to the cost of the first survey. Should the check survey prove the correctness of the first survey, the applicant loses his deposit, but if the first survey proves incorrect, the expense of the second survey

is borne by the department and the applicants deposit refunded.

As the farmers living on the outcrops of coal seams have been in the habit of sinking small pits secretly, inside barns, in cellars, etc., and of extracting coal for their own use and for sale, considerable trouble has been caused to legitimate mines. These workings have frequently broken through the barrens of coal left by the lessees at the outcrops of their seams, and have deranged ventilation, admitted surface water, and caused damage by fire. To meet this state of affairs, power is given to the inspectors to enter any premises, and if such openings are found, the amateur farmer-miners are liable to a fine, are bound to fill up their pits, and make good all damages.

Hitherto, although adequate fines awaited the man caught selling coal unlawfully mined, it was as a rule impossible to identify the coal, and there was no provision for searching premises unless under definite information. It is to be hoped that these measures will be found sufficient to put an end to this surreptitious mining, which might at any moment cause the loss of a valuable colliery.

Royalties on Railway Lands in British Columbia.

With a view to promoting the construction of railways, the Local Legislature of the Province of British Columbia has enacted, during its last session, that any such new companies shall have the right to levy a royalty not exceeding 5 per cent on all gold and silver that may hereafter be discovered on the lands granted to them. In introducing the measure, the Premier stated that the granting of a royalty on the precious metals was an entirely new departure. He reminded the House that in the early history of the province there was an export tax levied of fifty cents an ounce on all gold taken out of the mines as a consideration for the heavy expenditure by the Government in the construction of roads. "That tax," he said, "although not an unjust one, proved to be extremely unpopular, and was ultimately abandoned." And so we venture to predict will also be the present measure. Everyone will agree with Mr. Robson that it is of the greatest importance to the development of the Province that railways should be constructed to make its rich mineral areas accessible, and if it is necessary in order to effect this to offer some inducements to companies or individuals, the Government must do its best to further and promote so desirable an end. Only on this ground can a land grant be justified, and even then the concession should be fenced round with every possible safeguard to prevent the gift being used for speculative purposes. In Germany, Great Britain, and most European countries, and also in our own Province of Nova Scotia, the minerals are rightly regarded as belonging to the Crown, and a large

yearly revenue is derived therefrom. In this way the development of our mines proves directly beneficial to the country. But to grant monopolies to companies or individuals in the manner indicated by the Hon. Mr. Robson's measure will surely prove hurtful and injurious. It places a burdensome premium on the work of the explorer and the prospector. As the *News-Advertiser* very well points out:—"The management of a railway company has got to do the best it can for its shareholders, and if the miner, after discovering a vein of the precious metal, cannot work it at a profit, taking the payment of the royalty into account, what follows? Simply that the owner of the royalty, the railway company, steps in and gets possession of the claim, and, being itself free from any burden of a royalty, can make a profitable undertaking of it. There is also every probability that the railway company will transfer these royalties to another or a secondary company, whose business it would be to develop and control these land and mineral properties—an eminently practical and proper arrangement from the railway company's point of view. With such a middleman the condition of the miner would be still worse and an incubus would be saddled upon our mining industry which would, within a short time, create a feeling similar to that which two years ago caused such an agitation throughout Manitoba and the North-West, over the 'monopoly clause' in the Canadian Pacific Railway Charter."

Again, as our contemporary contends, the rate of the royalty is excessive and burdensome. "It will result in the smelting company charging the miner the usual prices for the treatment of the ore, with five per cent. additional on the value of the gold and silver to cover the royalty which it will have to pay over to the railway company. A smelting company, with a capital of \$100,000 sunk in plant and machinery, can, if operated properly, turn out in the course of a year base bullion of the value of \$1,000,000 for the gold and silver it contains, besides that of the copper, lead, or other inferior metals. Now the royalty of 5 per cent. on this would be \$50,000, or exactly 50 per cent. on the capital of the smelter, instead of the one-half of one per cent. on the same that the hon. gentleman figured by his method. If he will take the trouble to enquire what have been the results of the operations of the smelting companies at Leadville, Pueblo and Denver for the last ten years, he will find that the imposition of a tax on them which would have amounted, during that period, to the enormous sum of \$20,000,000, would have compelled them to suspend operations."

Meetings have been called and a vigorous protest will be made by the miners against the imposition of any such scheme as that submitted by the Hon. Mr. Robson.

An important meeting of the Gold Miners' Association of Nova Scotia will be held in the Halifax Hotel, at three o'clock in the afternoon of 3rd prox. Business of considerable interest to the Association will be discussed, and every member should make it a point to be present.

Instructions on the Immediate Remedies to be Applied in Cases of Accidents.*

Asphyxia.

Asphyxia is a state of apparent or real death caused by the stoppage of respiration.

Any cause which prevents a sufficient quantity of air from reaching the lungs may cause asphyxia. Such is drowning, strangulation, the compression of the chest (by something falling, for instance), the existence in the air of unbreathable gas, etc.

The first duty to fulfil in case of asphyxia is to remove the victim from the cause which occasioned the accident. We will not dwell upon the manner of drawing out a drowning man from the water, or upon the necessity of immediately loosening the rope from around the neck of a man hanging, etc. A few words are necessary on the precautions to be taken by the preserver in case of asphyxia from unbreathable gas, to prevent his being struck down himself.

He should commence by making an opening from without if possible, by means of ladders and poles, breaking the windows where the accident occurred so as to renew the air before going in.

If this cannot be done, he should put over his nose and mouth a cloth saturated with vinegar and water, and should pass around his body a strong rope, which will enable him to be pulled out should he lose consciousness.

Before going into the place he should draw a long breath and try and hold his breath until he should have opened all the apertures so as to let in the pure air. In certain cases where sufficient air cannot easily be let in (as in cellars, etc.), he should also carry a rope, the end of which is held outside and on the other end of which is a noose which he should attach to the victim's clothes, and that being done, he should quickly retire while the assistants will draw out the asphyxiated person. (If the gas that has caused the accident arises from the combustion of coal or pit coal, it would be useful before entering the room to throw in large quantities of water mixed with slack lime.)

In a case where the accident is caused by illuminating gas, he must take great care not to enter the room with a light, that might ignite the gas and cause an explosion.

Immediate help.—The man is then carried into a well-ventilated room, moderately warm, and should have around him only those absolutely required. As a general rule, in cases of asphyxia as well as for all other accidents, if it be a woman, the assistance should be given, if possible, by other women, and the cnrious should be strictly prohibited from entering. The victim should be undressed quickly, or if this be difficult the clothes should be cut with scissors. He should then be placed on a bed, or on a simple mattress placed on a table, after having placed a bolster under the shoulders to raise the body slightly, the head falling backwards. He is then covered with a light covering, and for want of better, with straw or dry hay. These preliminaries having been quickly done, the mouth of the asphyxiated is opened and a small piece of wood is placed between the teeth, or a handle of a spoon or some other flat object, not sharp, is inserted; the jaws are kept apart by placing a cork between the large teeth, and the tongue is drawn out with the fingers which are covered with a handkerchief or a cloth. With the finger or with the feathered

end of a feather, the nostrils, mouth and throat are cleared from mucus and froth that obstruct them.

All this is done quickly but methodically, while the assistants try to restore warmth and the circulation by dry rubbing, with hot bricks and irons and with hot smoothing irons wrapped in flannel and passed over the body. Rubbing with spirits with a flannel, a rough towel or a handful of straw is useful.

A lighted match should frequently be placed to the nostrils and a cork still wet with alcohol whose sharp penetrating vapour produces salutary irritation.

If, notwithstanding these manœuvres, the body still remains inert, and the respiration does not return, artificial respiration must be resorted to without too much delay.

Artificial Respiration by the Sylvester process: This process consists in producing, by movements of the arms, the play of the muscles that raise and lower the chest.

The operator places himself at the head of the asphyxiated who is lying on his back and raises his shoulders with a blanket or an article of clothing rolled up. The feet are supported and held by an assistant so that the body remains immovable.



Fig. 1.

It is needless to say that all the preceding precautions which have been described should have been taken, that the nose and the mouth should have been cleaned and that the tongue has been drawn out. In case of need, it is kept in this position by passing a handkerchief under the chin in such a manner that it is pressed between the teeth.

The operator then places himself at the head, he grasps the arms of the asphyxiated close to the elbows, the forearm being bent on to the

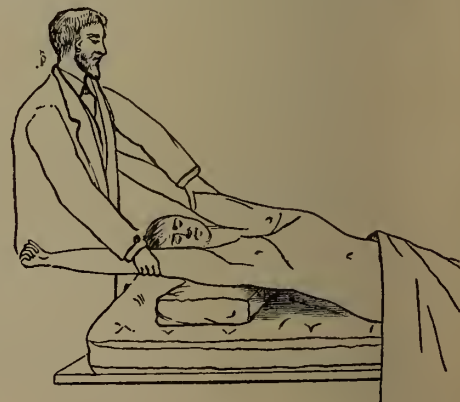


Fig. 2.

arm (Fig. 1), and having pressed them rather tightly on the sides of the chest, he then raises them quickly but without violence over the head, making them describe the arc of a circle (Fig. 2). He then brings them back to the first position and recommences the manœuvre, imitating the beats of normal respiration. The operator ceases

*Summary Extract of Chapters II and III of the work by Messrs. E. Ferrand & A. Delpéach, at Messrs. J. B. Baillière et Fils, 19 Rue Hautefeuille, in Paris.

after a few movements in order to judge the effect he has produced, and begins again if the respiration is not established of itself.

During these manœuvres the assistants continue rubbing under the covering or over the dry clothing; they renew the application of hot flannels, or bottles of hot water, or of hot bricks placed along the body, to the feet, or under the armpits.

As soon as there are signs of life we give the sick person a few spoonfuls of cordial, hot wine, grog, &c. If there be nausea we aid the vomiting by passing over the uvula an oiled feather.

Then we place the sick person in a warm bed, his head being slightly raised, and care should be taken to allow air to circulate well around him. It will not be long before he will fall asleep, but his sleep should be watched in case new symptoms of asphyxia should manifest themselves. We have seen persons asphyxiated return to life after a very long period (several hours); therefore we must, so long as any hope remains, continue to practice the artificial respiration, changing the operator so as to prevent fatigue.

Here are some of the signs by which we may know that all hope is gone:

If, on applying the ear to the chest in the region of the heart, we hear no beating; if a glass placed at a short distance from the mouth be not tarnished; if a hot coal, placed at the end of the toes, produces no sign of feeling or no blister.

Loss of Consciousness.

The loss of consciousness is due to various causes. Besides those we have already described as being caused by asphyxia, we will mention among the most ordinary cases: concussion of the brain (see farther on), overcome by heat, apoplexy, epilepsy (or *haut mal*), syncope. (We call syncope the state of a person who is ill either on account of emotion, weakness, loss of blood, etc.)

Immediate help.—Send away the curious; loosen the collar and belt; give as much air as possible.

If the face is pale (syncope) lay the sick person down flat, the head low, throw a few drops of cold water on his face, make him inhale vinegar, ammonia or ether, and rub the temples and forehead with vinegar and water, eau de cologne, etc.

If the face is highly colored (congestion, apoplexy) place the sick person on a bed, the head high and the legs hanging, and place on the head cloths dipped in cold or ice water. If there be vomiting, turn the head on one side to prevent the matter from being breathed into the lungs.

In case of epilepsy (which we distinguish by convulsions which accompany the loss of consciousness) all the cure consists in securing the sick person from the violence of the shock and the fall; put in the tongue, which might be caught between his teeth and bitten. We must then wait patiently until the workings cease of themselves.

Bruises.

CONTUSIONS.—They are the result of a violent shock against some body that will not yield (such as blows, falls, &c.) and are characterized by pain and swelling of the part affected, the skin remaining intact. A violent contusion without any of the vital organs being injured brings on syncope. (See what is to be done in such case.) Finally the contusion of some important internal organ, such as the brain, the lungs, may entail the most serious consequences and cause, according to the organ injured, the loss of consciousness, spitting of blood, &c.

Immediate help.—In cases of slight contusions apply wrung out cloths dipped in cold water or *eau blanche*. If the accident is more serious, carry the wounded person into a well-ventilated room, put him on a bed or mattress and be careful to remove everything that can interfere with his breathing. And while awaiting the doctor, keep, on the part injured, compresses of ice water, and renew these frequently.

WOUNDS.—Wounds are of different kinds according to their causes, such as a piercing, a shock, an incision, a tearing; their gravity depends on their extent, their depth and above the particular organs injured, such as blood vessels, lungs, heart, etc.

Immediate help.—Take scrupulous care not to touch the wound with dirty fingers, dirty cloths, sponges, and cover them with lint or cob-webs, &c.; all manœuvres that might introduce into the wound bad germs might be the cause of poisoning, and consequent blood poisoning and death. Clear the wound from anything that may soil it (such as sand, earth, &c.) by washing it thoroughly with pure water and better still with phenic water, and with the aid, if required, of a clean piece of linen such as a napkin, a handkerchief, &c.

While waiting for the doctor you should never permit any one to remove anything that has penetrated into the wound and which offers any resistance to a slight pull, we should not pull off either the pieces of skin adhering or the clots of blood which the water could not remove.

Cover the wound with a compress cold water, or, better still, phenic water, and keep it in its place by a napkin or linen band.

HEMORRHAGE.—Hemorrhage or loss of blood, which accompanies every wound, may assume such proportions as to necessitate immediate remedy.

Immediate help.—When the blood is thick, of a dark red color and flows gently and not by starts, it is generally sufficient after having removed everything from the wounded part that could interfere with the circulation, such as clothes, garters, etc., to press on the wound with the aid of the fingers or by means of a piece of linen moderately light.



Fig. 3.

This process is insufficient in the greater number of cases where a small artery is injured. In each case vermillion red blood flows from the wound by starts corresponding with the beatings of the heart, and death is imminent unless the hemorrhage is stopped. Compression of the principal artery of the limb, while awaiting medical aid is always the surest means of saving the life of the wounded.

It is important to know the places where this

operation can be more easily performed and consequently with more chance of success.

We will now enumerate them.

For a wound in the forearm or the hand seek the artery above the elbow in the inside of the arm besides the biceps muscle. (Fig. 3.)



Fig. 4.

For the lower limbs in the middle and a little above the fold in the thigh. (Fig. 4.)

For a wound in the head, seek the artery (carotide) near the middle of the neck on the front side of the principal muscle, which, from behind the ear, extends to nearly the middle of the chest and press it from the front to the back of the vertebra of the neck. (Fig. 5.)

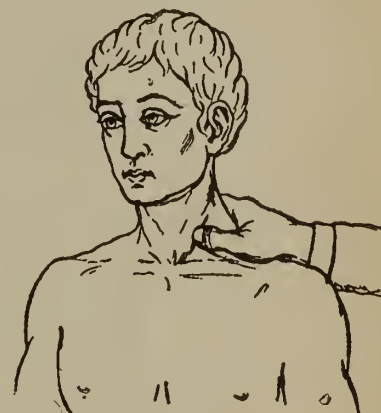


Fig. 5.

The cessation of the hemorrhage will indicate that we have found what we sought.

If we do not succeed in stopping the blood in this way we must try and produce with compression by means of elastic bands (such as suspenders, etc.) bound round the injured limb above the wound. Should it be required, we should use a cloth folded like a cravat, the ends of

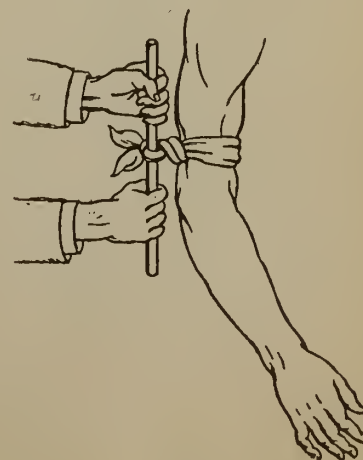


Fig. 6.

which we fasten in a knot and under which knot we pass a piece of wood (a cane, etc.), sufficiently long that by turning it we succeed to tighten the cloth and compress tightly the limb. (Fig. 6 and 7).



Fig. 7.

WRENCH (SPRAINS).—*Immediate help.*—Apply fresh water in the form of a bath, running water, or compresses frequently renewed.

DISLOCATIONS.—There is dislocation every time that the extremity of a bone comes out of its natural cavity to take a wrong position. We are notified of the dislocation by the characteristic malformation of the place when compared with the symmetrical one, by the change in the length of the limb and by the inability of the injured person to perform certain movements. These dislocations are caused by falls, violent movements made in abnormal positions, sometimes by blows.

Immediate help.—It would be dangerous to attempt the work of replacement, which to be of any use would require accurate anatomical skill. We must then content ourselves by the exercise of palliative measures that will soothe the patient and stop the swelling of the part, until such time as the doctor arrives.

We must simply apply compresses of (eau blanche) sugar of lead water and keep the sick person lying down in the least fatiguing position possible.

FRACTURES.—The immediate symptoms of a fracture are the impossibility or difficulty of



Fig. 8.

moving the injured limb, the change more or less great from its natural position, and the rubbing of the two ends of the broken bones. We may notice also in the parts that are held

together by a single bone, such as the arm, an unnatural bend, and the individual movements of the two parts which form the bone.

Immediate help.—We must avoid all protracted attempts to assume ourselves that there is really a fracture and apply the remedy indicated as if we were positively certain. The first thing to be done is as simple as possible, and is intended to keep the limb immovable in its normal position. It is formed of small pieces of wood (splints) which are cut the necessary length and thickness, and pieces of thick cardboard. While these are being prepared the injured limb should be covered with a compress dipped in cold (eau blanche) sugar of lead water. Then the splints covered with wadding or a soft thick cloth, are put around the limb and then fixed with bands or several handkerchiefs.

The figures 8, 9, 10, 11 and 12 render it unnecessary for us to enter into further details.

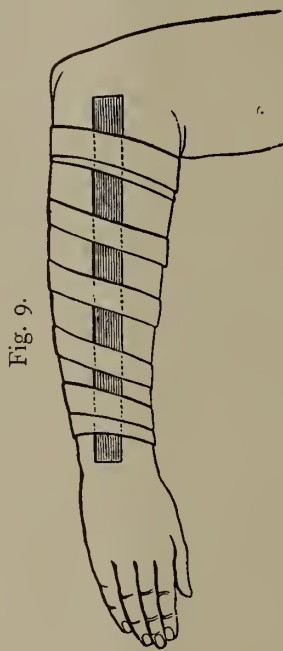


Fig. 9.

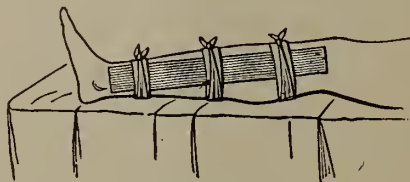


Fig. 10.



Fig. 11.

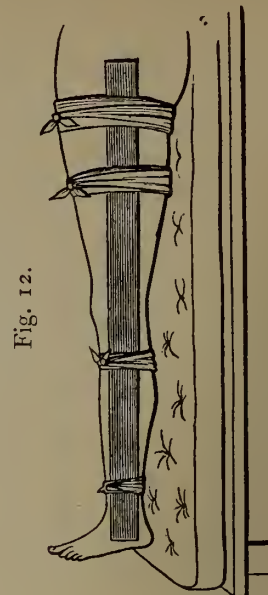


Fig. 12.

When the fracture is rendered worse by wounds, we must commence by attending to these as has been indicated; and after having covered the wounds with compresses, we apply the provisional remedy.

The doctor should be called within the shortest delay. He alone is authorized to make a thorough examination of the injured limb, to unite the fracture and apply the final application. To wait too long entails much trouble; the painful swelling of the muscles next the fracture is an obstacle to the putting on of the bandage, which delays and interferes with the cure.

In case of a fracture of the arms, the injured person should, if his strength is sufficient, seek his own dwelling or that of the doctor, that is if the distance to travel is not too great. See on Fig. 11 the position of the sling used to support the arm.

If the fracture be in the lower limbs the patient should not in any case be allowed to walk.

To carry the wounded we must use a stretcher or upon something made to resemble it.

A plank, a shutter or a door can be used; it should be covered with a straw bed or dry grass, and care should be taken, by some means or other, to keep the head raised.

BURNS.—*Immediate Help.*—When a person's clothes are on fire the first thing to do is to smother the flames by whatever means may be at hand; you should at once cover them with a cloak, a blanket, a quilt, a carpet, &c., and wrap it closely around him. The fire being extinguished, we should relieve him of his clothes, using scissors if necessary, so as to prevent the rubbing which might pull away the flesh and cause intense suffering. If pieces of the cloth remain stuck to the flesh it is better to leave them than to try and remove them.

Open the blister by a prick from the extreme point of a pin; but take great care to protect the skin that covers the sore and prevent direct contact with the air. Apply on the burned parts a linament which is obtained by shaking in a corked bottle a mixture in equal parts of oil and lime, or if this cannot be obtained, use olive oil, butter or any other grease spread on cotton.

When the burns are caused by *chemical caustics*, we should be careful not to use water in the first instance; it would only excite the corrosive action, causing intense suffering; we must try, on the contrary, to extract what remains of the caustic by touching it gently with wadding or lint, until the drying up of the sore, and then only should there be frequent washing with

alkaline water (a solution of carbonate of soda, etc.), soap suds, lime water. If the burn is caused by acids, then wash with vinegar water; if by burns from potash or soda, ammonia or quick lime is used.

FOREIGN BODIES INTRODUCED INTO NATURAL CAVITIES.—If a foreign body has penetrated the eye, the nose or the ears, and if it cannot be pulled out very easily, we should await the arrival of the doctor.

When a foreign body has entered the throat which, leaving aside the inconvenience and discomfort, might cause suffocation and even asphyxia, we should try and remove it with the aid of the finger.

If this means is not successful, we must try and drive it down by making the patient swallow small balls of bread crumbs, or pieces of cooked potatoes, as large as possible. If there be suffocation, try and make the patient vomit, by making him drink warm water or by tickling the palate.

POISONING.—*Immediate help.*—While waiting for the doctor, for whom we must send quickly, try and remove the poison as quick as possible, by causing vomiting. For that purpose, make him drink large quantities of lukewarm water, tickle the throat with the finger or a feather.

Give him, moreover, emollient and softening drinks, such as milk (which should be given in the first place) and albumen water (which is made by beating the whites of four eggs in a pint of water) gum water, etc.

If it is known what poisons have to be dealt with, the following substances may be given:—

In poisoning with *acids* (sulphuric acid, or vitrol, nitric, etc.) carbonate of soda, pounded chalk, magnesia, etc., dissolved or soaked in a good deal of water is used.

In poisoning with *alkalies* (caustic soda or potash, etc.) water slightly flavored with vinegar or acidulated milk with the juice of lemon is used.

With *arsenic*, magnesia mixed with water.

With *salts of mercury* (corrosive sublimate, etc.) the white of an egg.

With *phosphorons*, magnesia and over and above, ten drops of the essence of turpentine in milk every half hour.

Avoid oil and fatty substances.

Finally, if we have to deal with *vegetable poisons* (such as opium, belladonna, etc.) administer strong black coffee and spirits, and apply compresses of cold water to the head.

CONTENTS OF AN AID BOX.

Bottle of ammonia (volatile alkali).

do spirits of camphor.

do extract sugar of lead.

To prepare (*eau blanche*) mix 2 tablespoonfuls of extract of sugar of lead in a pint of water.

Bottle of 100 grammes of high wines and phenic acid at 90 per cent.

To prepare phenic water (*l'eau pheniquée*), mix 2 tablespoonfuls of that solution in a pint of water, and shake the mixture so as to dissolve all the phenic acid, which commences by separating in the form of oily drops.

Bottle of vinegar.

do oil of almonds.

do lime water.

An empty bottle to prepare the calcareous liniment.

Bottle of *eau de melisse*.

do hydrate of magnesia.

A few linen hands; a few rolls of lint for dressing.

A few splinters of wood (splints) for fractures.

The Belgian Collier's System of Benefit Organization.

The Mariemont and Bascoup Coal Companies employ over 6,000 persons of the working class.

In the work of mining the system of sale and that of premiums have been in use for the last fourteen years and have proved eminently satisfactory to the interest of both master and workman.

Sales.—Certain kinds of work with mines, the condition of which rarely change, may be put up to auction. Herein the workman finds many advantages, a settled price for his work during a certain period of time agreed upon, the security it gives him, the power of choosing as partners in his work, workmen of the same ability as himself, and the chance of his wages increasing in proportion to the work done, provided work is regular and favorable, &c.

Bargains.—The care of the underground ways, the different repairs to be made and especially the cutting of coal are all subjects of bargaining; that is the price discussed between the engineers or their assistants and the workmen.

Premiums.—Since the system of premiums has been introduced for all workmen loading, driving or drawing the coal from the pits, their wages now consist of one fixed part, and of one proportionate part in accordance with the number of cars that have passed through their hands, or with the quantity of coal taken from the pits. This system is a real stimulus for the workmen, and a certainty for the owner, of coal being mined with regularity.

Contracts.—In dealing out the material from their repair shops, stores, &c., the organization of work by the job has been extended to all workmen without distinction, although in certain classes of work, such as drawing up coal and repairs, difficulties are incontestably met with. Its results are an increase of wages of 20 per cent. with a proportionate decrease in the price of returns. The greater part of the yearly work such as the driving of machines, the repair and the care of the material are all contracted for, the contracts not extending over a year. They are signed by the coal companies and the bands of workmen who accept them. The amount for which they are accepted is frequently based on the quantity of coal extracted. All the risks of the work, which very often varies in quantity, are accepted by the workmen. Past experience shows that, though the coal company may at times advance money, and at others the workmen may advance work, in the end the compensation is about equalized. Besides, the profits made by the contractors show that the confidence in the results was not misplaced. They have, in fact, signed new contracts under conditions entailing reductions of 20, 30 and even forty per cent. in favor of the companies. If, therefore, their wages have not diminished it must be because they have worked harder, or they have improved their manner of working, making it more intelligent and have thus seconded the efforts made by their superiors in providing improved implements.

Colorado's Mineral Palace.—The mineral palace now being erected at Pueblo, Col., will cost about \$250,000. It will be of handsome design, the exterior being a series of square columns and beautifully polished stone. The carving will be ornate. All parts of the building will be made of the products of Colorado's mines, the owners in all the counties in the State having sent in their choicest and richest specimens. In the interior will be seen every variety of mineral production, from stone and coal to pure gold, the value of which will be at least \$750,000. The expense of developing this grand and brilliant conception will be assumed by the public spirited citizens of Colorado. It is intended to be a permanent exhibit, open every day the year round, and its originators desire to have the choicest specimens of mineral wealth from every State in the Union represented side by side with the resources of Colorado. Building stone, granite and marble are also desired. The building will be lighted by 3,000 incandescent electric lights. It is the intention to reproduce this in duplicate of design and brilliancy of decoration and display, but somewhat reduced in size, as the Colorado mineral exhibit for the World's Fair, in Chicago in 1892, should that scheme materialize.

Gold Mining in British Guiana.—The last shipment of gold—3,483 ounces, valued at \$62,000 in round figures—is the largest on record in the Custom house books, the largest exports by a single mail hitherto having been those of 2,263 ounces a few weeks ago, and 2,514 ounces in December last. Including the latest shipments above mentioned, the gold returns for the year show 12,884 ounces, valued at \$231,632. Last year, up to 15th April, there had been sent away 5,846 ounces, declared to be worth \$100,171, from which it will be seen that, as far as it has gone, this year's export has been more than twice as large as that in the corresponding period of 1889. The gold royalty for 1890 stands at present at the respectable figure of about 11,500 ounces.

Meeting of the General Mining Association.

The annual general meeting of the proprietors of the General Mining Association, Limited, was held at the offices, Blomfield House, London Wall, E.C.

Mr. J. Duke Hill, who presided, formally moved the adoption of the report and account, and that a dividend of 6s. per share be declared.

Mr. F. W. Bigge seconded the motion.

Mr. Descou complained that the meeting had not been called earlier. It seemed to him that four months was a long time to wait to complete the accounts of the association. He also suggested that the proprietors should be furnished with a report of the affairs of the Association more often than once a year.

Mr. Swan stated in reply that the preparation of the accounts at the mines took some time to complete, and then they had to be sent to London. It would be useless for the board to send reports out as often as Mr. Descou had suggested, as there would be nothing to communicate to the proprietors.

The motion was then put and carried.

After the re-election of the retiring directors, a vote of thanks was given to the chairman for presiding.

The Immense Profits of the Tharsis Sulphur and Copper Co.—In spite of the fall in the price of copper, the net profits earned last year by this company amounted to no less than £249,189 15s. 6d., enabling the directors to maintain the previous year's dividend of 20 per cent. Over and above this immense profit the company has a claim against the Société de Métaux for £263,915 1s. 6d. It may be of interest to add a line as to the dividends that have been paid by this company. In the first year of its existence (1868) it paid a dividend of 10 per cent.; in 1869 5 per cent. was paid, but this rate advanced till 40 per cent. was reached in 1872. Since then the rate has averaged exactly 20 per cent., 27½ per cent. being paid in the two years 1882 and 1883, and 7½ per cent. in 1886.

'Eiffel' Tower for the World's Fair at Chicago.

—M. Eiffel, who erected the great Eiffel tower, which formed such an important and successful feature of the recent International Exposition in Paris, has made a proposition to the World's Fair directors to erect a similar structure in Chicago, and to provide the entire capital needed for its construction, should the directors approve of his proposition. It will be the joint enterprise of M. Eiffel and Thomas A Edison, and the tower will be higher than the original structure by at least 500 feet. Mr. Edison, it is said, will place a million incandescent lights of various colors upon the structure.

A Dry Machine for Alluvial Gold.—The Whitty machine which was successfully tried at Johannesburg the other day is thus described: It is a green looking affair of perhaps seven feet in height; simple enough in its working and doubtless meritorious enough to ensure something of the boom anticipated by the American company who are introducing it. The machine was at work the other afternoon in the yard to the rear of Messrs. Turner's premises in Simmonds St., Johannesburg. According to Mr. Whitty—and as was pretty plain to all—the machine was simplicity itself. The virgin soil is first put through the clod breakers, which are fixed with screws so as to reduce the wash to a proper size to enable it to run through the separator. It is then placed in a hopper with an automatic feeder, which distributes a thin layer over the amalgamating plates, so constructed as to hold continuous walls of mercury in the shape of rifles. All the finer gold is amalgamated on the first plate; the coarser gold and pebbles falling into the concentrator beneath—a specific gravity plate of rough canvas on which is laid the mercury charged rifles. An intermittent force of air comes from the bellows, behind which, striking the canvas plate, drives the tailings on to the floor, the rougher earth and probable gold being held in tow for the examiner. Which, being interpreted, means that the dry earth is poured into a box at the top of the machine, is allowed to drop through by automatic action on to the sensitive plate beneath, where cascade fashion, it dribbled down to the bottom, leaving its golden wealth (if any) behind in finer particles and taking the rougher and more acceptable nuggets to the plate beneath. This plate being of canvas is blown at by an automatic Boreas behind, the result being that while the superfluous earth is blown to the ground as tailings, the pebbles and nuggets remain, attracted by the gridiron arrangement, topful of irresistible mercury. Then when the business is over for the day, these concentrates are swept off in a pan, and the nuggets picked out as easily as winkles. The hand power of the machine, it was stated, will treat between 15 to 20 tons of earth a day—a fact which, contrasted with the present method in use, speaks for itself. The earth must be dry—the dryer the better—before it can be treated; and the machine itself is adapted either to hand labor or working by steam.

Our Portrait Gallery.

[A series of portraits and biographical sketches of Canadian mining engineers, mine managers, inspectors, geologists, explorers, etc.]

No. II.

Mr. H. S. Poole, General Manager of the Acadia Coal Co. (Ltd.), Stellarton, N.S.

Mr. H. S. Poole, General Manager of the Acadia Coal Company (Limited), and formerly Inspector of mines for the Province of Nova Scotia, was born at Stellarton, N.S., in 1844. He is the son of the late Henry Poole, a well known mining engineer, who managed the Albion mines for fourteen years prior to the surrender in 1887 of that company's monopoly of all the minerals of the province, and who also reported for the Government on the newly discovered gold fields in 1863, and still later was manager of the Caledonia Colliery in Cape Breton.

Mr. Poole is a graduate of King's College, Windsor, and is an Associate of the Royal School of Mines, London, where he studied under the well known leaders in science, Professors Hoffman, Huxley, Tyndall, Smith and Percy. He has been a Fellow of the Geological Society since 1866 and is a member of several other scientific societies, to which he has contributed papers. When the Canadian Society of Civil Engineers was formed he was honoured with a seat at the first Council Board. Having finished his studies in London and returned to Nova Scotia he was employed under his father's management at the Caledonia Colliery, Cape Breton, where Mr. David MacKeen, M.P., is now Managing Director and part owner. There he remained until 1870, when he went to Utah and Nevada, mainly to benefit his health, but also in a professional capacity, to report on some silver mines. As an episode in this portion of his career, it should be stated that he was for a month with a Japanese Commission at Washington, at the time when that wonderful people were boldly casting off their venerable civilization for that of the more restless West. Afterwards he spent a year among the silver mines of Utah. In 1872 he once more returned to his native province to succeed Mr. John Rutherford as Inspector of Mines, and this position he filled with great credit to himself and to the province for a period of six years.

As Inspector he marked his term of office by inducing the Government of that day to adopt for the better regulation of the mines an Act based on that of England, and he added thereto, with Government concurrence, special clauses having in view the preservation for future miners of approaches to the large submarine coal field that extends off the Cape Breton coast. He also remodelled the forms on which information is annually given to the public in the official reports to the Department, giving them the

shape they continue to have to-day.

Nova Scotia owes much to Mr. Poole for the fearless conscientious discharge of his duties as inspector during the years in which he held this office, for his efforts to enforce the authority of the law and secure that discipline and attention upon which the safety of the mines depends. Of the Annual Reports we can only speak in terms of unqualified praise. The work of the Department was not limited to the collection of royalty from the mines or to the publication of statistics of the yield, value and destination of their products, useful chiefly to the economist and historian. The Inspector was by training and experience quite competent to instruct owners as to the best means of opening and work-



Yours Truly
H. S. Poole

ing mines and of utilizing and marketing their products, and to recommend modifications and improvements in mining practices which had been adopted elsewhere. The reports became valuable memoirs on the great mining industries of Nova Scotia, descriptions of the coal, iron, gold, manganese, antimony, copper, lead, gypsum, barytes, limestone and other economic ores and minerals; of their modes of occurrence, of every question of practical application to their extraction; of the cost of production, the labour and materials employed. Methods of mining were compared with those in use in other countries; a complete history was given of the growth, progress and condition of every mining district, and suggestions made for their future development.

In his first Report, which contains numerous carefully compiled statistical tables, references to mining practices abroad, to appliances for coal cutting, to the use of dynamite in the gold mines, Mr. Poole urged the necessity for greater attention to the condition of the mines and for the enforcement of stringent rules to guard against the recklessness with which miners will expose their lives to dangers which, although known to be imminent, are familiar, invisible and temporarily doubtful. He insisted that immediate revision of the law relating to mines was preferable to waiting until some appalling accident, from which happily the province had hitherto been free, too plainly should point to the necessity for legislative interference. The warning was not too soon. This report was written on February 15th, 1873, and on May 13th occurred the disaster at the Drummond colliery, an explosion of gas in a fiery portion of the mine by the careless use of powder, which resulted in the loss of sixty lives and a greater destruction of property than in any previous similar occurrence in America.

The next annual Report recommends some improvements in the handling of coal, points out the necessity for complete and accurate plans of underground workings, and further advocates that the law should require that those in charge of mines, all colliery officials such as managers, deputies and firemen, should be men in whom trust can be placed, men who by practical experience and professional education are fit to fill the positions they hold, and should be required to possess certificates according to their positions. It condemns the Arab-like wanderings in the gold fields of irresponsible tributaries who try new places, open up old mines and again abandon them, stripping the outcrops of the leads and making them reservoirs for water, and but temporarily securing the openings. Interesting sections are given of one of the leads in the Montague district, to show the distribution of gold in different parts of the workings.

Among the questions considered by Mr. Poole in subsequent reports is that of the duties of the inspector and the extent of his responsibility as compared with that of those in charge of the mines, whose constant care and watchfulness, coupled with good discipline, he shows to be the only safeguards against accidents. The history of royalties and a comparison of the custom of Nova Scotia with that of other countries, leases, spontaneous combustion of coal, colliery machinery, ventilation, explosions in mines, submarine workings, review of the coal trade, boiler incrustations, treatment of gold-bearing ores, tables of analyses of iron ores—these and other cognate subjects of practical interest are concisely treated with extraordinary ability in his reports.

In 1876 he contributed much valuable information to the Royal Commission, of which the Rt. Hon. Mr. Childers was chairman, and it is published in their report on the spontaneous combustion of coal in ships.

In 1879 Mr. Poole resigned his position as Inspector of Mines to take that of manager of the Acadia colliery at Westville, made vacant by the failing health of the late Mr. Jesse Hoyt.

Previous to 1886 there were four active coal companies competing in the Pictou Field, whose operations did not always result advantageously to their respective shareholders, and in that year three of them—the Vale, the Acadia and the Halifax—were amalgamated. Mr. Poole, who previously had acted for the Acadia company alone, was placed in general charge. The amalgamation consolidated leases cover some 13 square miles, of which but a portion is at present known to contain workable beds of coal. The management of this property involves the consideration of many serious problems, the record of the district being anything but enviable; calamities by explosions of gas, irruptions of water, and loss of pits by subterranean fires, which have continued to smoulder and occasionally break out destructively, have marked that of the past twenty years.

The pits in Pictou County are the deepest in the Province. The Acadia pit has workings under 1,500 feet of super-incumbent strata, with depth not only is the cost of pumping water and winding coal seriously increased, but the resulting pressure adds to the expense of maintaining the necessary roads.

Thorough, painstaking and careful, intimately acquainted with everything about the mines, as manager he inspires confidence in his professional knowledge; not readily swayed by prejudice or passion, solicitous for the welfare of the miners, affable and easily approached, he is liked and respected, but permits no disobedience of orders. His managers at the Acadia and Albion mines, Messrs. James Maxwell and J. G. Rutherford, are instructors in the Government schools for miners, while Mr. W. B. Moore and T. M. Turnbull are in charge of the Vale. The mine with which he has been longest connected is the most successful in the district. The importance of these coal mines is shown by the prosperity of the neighbouring towns of Pictou, New Glasgow, Westville, and Stellarton, and of the whole county of Pictou. To win the coal at great depths in fiery mines from beds thicker than are worked elsewhere, but of changeable character, highly inclined, interrupted by faults and having often a dangerous roof; to recover or avoid breaking into old workings, are problems which tax to the utmost the powers of the mining engineer entrusted with the lives of hundreds who are engaged in a perilous occupation, he must foresee and guard against danger and loss, and husband the resources of the mines. The responsibility is heavy, but in every crisis Mr.

Poole has done, and will do, all that coolness, skill and promptness to plan and execute can effect.

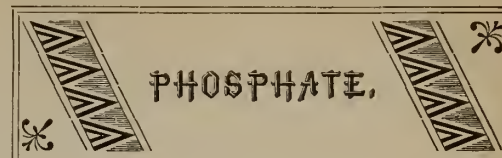
As the observant practical miner and mine engineer often makes a good geologist, Mr. Poole has also set himself with equal success to solve certain vexed questions in the geology of a province which has produced many geologists. In 1873 he read before the Nova Scotian Institute of Natural Science a paper on the geology of the Nevada silver mines, the great American desert, the gravel benches, hot sulphur springs and changes of level of the Great Salt Lake. In 1879 followed a contribution to the Geological Society of London, of which he has been a member for more than twenty years, "On the Gold Leads of Nova Scotia," in which he agrees with Dr. Selwyn of the Geological Survey in regarding these leads as true mineral veins, rather than as beds of contemporaneous age with the quartzite and slate in which they are enclosed, as assumed by Professor Hind and Dr. Hunt, thus "rendering a most useful service to geology in completely upsetting the theory of the bedded origin of the leads." He maintains also that the granites of the gold fields are of intrusive origin and not merely highly metamorphic rocks. In other papers he has discussed the question of the glaciation of the country and the origin and course of the drift.

In 1881 he read before the Institute of Natural Science "Notes on the Ice Storm of January 24th, 1881"; in 1885, before the American Institute of Mining Engineers, a paper on "The Pictou Coal Fields," including, besides particulars regarding the machinery and methods of working at the different mines, an account of the geological structure of the coalfields, of which he has since that time made a much more thorough survey; and in 1889, before the Canadian Society of Civil Engineers, "The History of One of the Oldest Railroads in America—that between the Albion Mines and the loading-ground."

It should be stated that Mr. Poole is also Vice-President of the Nova Scotia Steel and Forge Company of New Glasgow, a concern that has spent \$400,000, chiefly of local capital. As is well known this enterprising company is doing a large business, and is now proposing to include a blast furnace. The products are open-hearth steel, nail plate, machinery steel, car axles, &c., &c.

We hope to include in our next issue a sketch of Mr. Archibald Dick, Chief Inspector of Mines for the Province of British Columbia.

The Canadian Rand Drill Company give notice of an application for incorporation. The applicants are:—Addison C. Rand, of the Rand Drill Co., New York; S. W. Jenckes, of the Jenckes Machine Co., Sherbrooke; J. M. Jenckes, Sherbrooke; F. A. Halsey, Mechanical Engineer, and Wm. Farwell, Manager of the Eastern Townships Bank, all of Sherbrooke. The capital stock will be \$18,000, in 180 shares of \$100. The company will manufacture in Canada, Rand Drills, Air Compressors, General Mining Machinery and supplies.



In General.

Mr. G. C. Lomer, of the firm of Andrew Hunter & Co., London, has arrived on this side for a short visit, and will make a trip through the mining districts.

Markets.

The European market is weak on account of a drop of one penny unit in Charleston, and the lower freights that are ruling. Manufacturers are busy on the other side at present in manufacturing and shipping manufactured goods, so that they are in no humor for purchasing.

Shipments.

Messrs. Lomer, Rohr & Co., Millar & Co. and Wilson Green have been making regular shipments to Europe since resumption of navigation, from the port of Montreal. Full particulars of quantities exported per ocean freight will be given in our next issue.

The shipments of ground phosphate from the Ottawa Valley to United States, from 1st January to 30th ult., have been:—

Month.	Quantity.	Designation.
January.....	7½ tons.	Holyoke, Mass, US
February.....	340 do	Holyoke, Mass, US
March	100 do	Holyoke, Mass, US
April	200 do	Holyoke, Mass, US

Kingston District.

The Kingston Phosphate Mining Co. has been registered in London, with a capital of £5,000 sterling, to acquire and work the property adjoining the Foxton mines. Messrs. Lomer, Rohr & Co. have been appointed agents in Canada.

Active operations have been begun under the new management at the Bobbs Lake Pits, formerly operated by the Anglo-Canadian Phosphate Co., and from present indications a large output is expected.

Templeton District.

At the McLaurin Co.'s pits work progresses satisfactorily. About 100 tons per week are being mined from the Blackburn.

Freights.

Messrs. Lomer, Rohr & Co. report having made contracts for London and Liverpool at 5s. per Tramps.

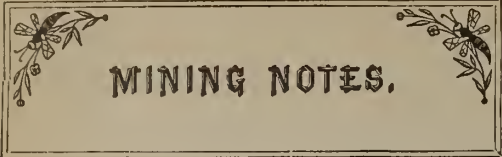
Lievres District.

Operations at the North Star, High Rock, Emerald and Central Lake Mines are being pushed vigorously, and satisfactory shipments are being made.

The Anglo-Continental Guano Company, operating the Aetna Hill and Lansdowne properties, purpose to submit to arbitration the dispute respecting the line dividing their property from that of the Ottawa Mining Co. A re-survey by independent surveyors will probably be made. The Anglo-Continental Company estimate that about 2,000 tons of ore have been taken out of the workings on their side of the line.

The Canadian Phosphate Company expect to have a large increase in their shipments this year. The pits are all doing well at present. A full report of the annual meeting of shareholders is given in another portion of this issue.

The annual general meeting of the Dominion Phosphate Company was held at Montreal on 20th inst. The report of the year's operations was very satisfactory, inasmuch as a very large output of high grade phosphate was made, resulting in a most satisfactory profit to the shareholders. Mr. R. N. Hall, M.P., has returned to London to complete the negotiations for the transfer of the mines to the English syndicate by whom they have been acquired. At date of writing Messrs. Charles Kyte and John Williams, of New York, directors of the company, are visiting the mines. Capt. Williams and a small force are placing the property in good shape for transfer.



MINING NOTES.

Nova Scotia.

Strong winds have at last driven off the drift ice, and Pictou Co. is prepared to ship coal, but no craft has yet loaded for Montreal; all shipments so far have been local. Mining questions have for the present been laid aside here, and local politics absorb all attention, the election being on the 21st inst.

During the session of the Nova Scotia House of Assembly just closed, the Committee on Mines and Minerals made a report recommending the separation of the Department of Public Works from that of Mines. This separation would be in the interest of the mining industry, and has been advocated for some time by the Gold Miners' Association. The public have suffered for years from the lack of proper clerical force in the Mines Department, and from the lack of a Commissioner who could devote his whole time to that Department. The business of the Mines Office has grown wonderfully in recent years, and is still increasing, and its receipts are nearly one-third of the total revenue of the Province. Under these circumstances the Government could pass no single measure which would meet with more approbation from those concerned in mining than that recommended by the report.

The Committee also inquired into three petitions which claimed damages for mistakes and errors committed by the Department. In the petition of Hemeon no claim was allowed; in the petitions of Thompson and of Cameron damages were recommended to be paid.

The Nova Scotia Steel and Iron Company, New Glasgow, N.S., operating under a new charter granted by the Legislature of Nova Scotia, have issued a prospectus relating to their business. The authorized capital is \$2,000,000. The company are now employing about 450 men, and look to increasing the number as soon as they get to work building their blast furnace, etc., which will be immediately.

The steamer *Eveline* which was to have opened the St. Lawrence coal trade with a cargo from Cow Bay got on the rocks and is being repaired at Halifax.

The miners at Cow Point have returned to work, the management having abolished the weighing complained of, and it is expected that an advance in coal cutting rates will also be conceded.

Mr. John McIntosh, Stellarton, has secured the contract for erecting twenty coke ovens for the Intercolonial Coal Company, Westville. The ovens will be of the beehive pattern. It is said after these are built more will be constructed.

Mr. A. R. McDonald, who has spent some time prospecting for coal near Little Harbor, claims to have found a promising outcrop near Woodburn, New Glasgow, and is forming a company with a view to further explorations thereon.

Wine Harbor District.

New hoisting and pumping machinery is now erecting on the properties operated by Mr. H. T. Harding, of Truro. These properties for some time have required more powerful machinery, and when the new gear is in place the output will be materially increased. The engine was built by W. W. Howell & Co., of Halifax.

Mr. Robt. McNaughton has begun work on the areas immediately east of the Harding property. A shaft in the middle lode has been cleaned out and is now sinking.

Sherbrooke District.

Work in the Peninsula Co.'s mines has been temporarily discontinued.

At Goldenville little or nothing is doing. The exorbitant prices at which idle properties, which are really nothing but prospects, are held, are effectual barriers in the way of reviving this district.

Beaver Dam District.

Mr. Turnbull is erecting a small saw mill to cut the lumber for his new stamp mill. A large portion of the iron work and machinery is on the ground, and the work of erection is going forward steadily.

Yarmouth District.

It is reported that F. W. Christie has obtained a working lease on the old Cowan property. It is also rumored that a suit has been instituted by some creditors of the old company for non-payment of debts.

Gay's River District.

M. B. Gladwin, acting for a syndicate, has put down a shaft through the conglomerate in this vicinity and found gold-bearing material below. The shaft lies at some considerable distance from the old mines, and to the northward.

Nothing is yet doing on the Anderson-McDonald property, formerly McClure's, but it is understood that work will be resumed this summer.

Stormont District.

The Palgrave Co. are still idle, awaiting the issue of some legal matters.

The North Star lode is looking well. The lode runs from six to ten inches in width, and is reported worth \$40 per ton. A new wharf is under construction near the property, and arrangements have been made with the packet steamer to land at that wharf.

Renfrew District.

C. H. North, the owner of the "Empress" mines in this district, has decided to unwater and prospect the old "Ophir" lodes upon his property. These lodes, particularly the South Ophir, were the chief producers some fifteen years ago, and are opened to a depth of about 400 feet. Mr. D. S. Turnbull, superintendent of the Empress Co. is putting in dams and a Vulcan wheel, the object being to transmit all the power required for unwatering and developing from the falls in Meadow Brook to the Ophir shafts, a distance of some 700 feet. Mr. Turnbull will use a 1/2 inch endless wire rope, the slack being carried on idlers, three feet in diameter. The driving pulley will be 10 feet in diameter, and the driver 6 feet in diameter.

Malaga District.

The Malaga Mining Co., Ltd., have reduced their force of miners.

The Parker-Douglass Co. have about completed their surveys for the transmission of their power from Wildcat Run. The Truro Foundry Co., which is the only concern in the Province having any experience in this matter, are making estimates on the transmission by wire rope. The Sprague Electric Motor Co. are in correspondence with reference to transmission by electricity.

Quebec.

Quite a number of new engines are being added to the different plants in the asbestos region. Bell's Co. have a new hoisting engine, and Messrs. King Bros. are putting in a complete plant of hoisting and air compressing machines.

The Anglo-Canadian Asbestos Company at Black Lake is working ahead full swing and making good progress. Recent operations have exposed some very good ground to the rear of the property adjoining that of the United Asbestos Company. A new hoisting plant has been put in to extend the workings at this point, and the management contemplate some still further additions to their plant.

The Beaver Asbestos Co. have their machinery on the ground and it is being put in place with all speed. Very little work has as yet been done on the property of this company, but the openings that have been made, show numerous veins of fine clean asbestos of the usual Thetford quality.

The Thetford Mining Co. have resumed operations at their pits. Work on this property was suspended in the autumn.

Work at the pits of all the companies is being pushed with the usual energy and all are striving to improve on last year's output, as is evidenced by the addition of new and improved working plants.

At Black Lake, Bell's Co. Southward mine has not yet been opened.

On the property of the United Asbestos Co., (limited) new ground is being opened and all the pits look very promising. There are at present four pits working.

Messrs. King Bros. have commenced work on their property near the Black Lake Station. The asbestos shows in good quantity and the veins are good sized.

The American Asbestos Co. (limited) are working a good force and their pits look very nice. On the hill they are putting in a new hoist to be run by compressed air. They are laying down larger pipe and will put a large Receiver on the hill so as to command a better supply of air. A vein taken from one of their pits a few days ago measured about 7 1/2 inches in width. This is perhaps the largest that has ever been found at any of these mines. Several pits situated at too great a distance to be operated by their own machinery are being worked by contract.

The Exploration Co. of D'Israeli are erecting a building on the Lot adjoining the Laurier Co. and are also doing some exploring.

Some exploring has been done on the Lot taken by the Laurier Mining Co.

We are much pleased to learn of the formation of a union of the asbestos mine-owners and managers, to be styled "The Asbestos Club," with head-quarters at Black Lake, Que. The aim and objects of the club, are:—

- To promote meetings of persons directly or indirectly interested in the mining and manufacturing of Asbestos, in order to discuss matters of mutual interest.
- To keep on file a selection of suitable newspapers, periodicals, books, etc., for the use of members.
- To give impartial information about mines and properties, to the benefit of asbestos mining in general.
- To try to adopt such measures which will enable the various mining companies to insure their employees against accidents, etc., on a co-operative system.
- To act as arbitrators whenever called upon to settle disputes between parties connected with the club.
- To promote social intercourse of members and their friends.

The new club starts with a membership of 35, including not only the local managers, but others interested, directly or indirectly in the industry, resident in New York, Boston and other outside points. We heartily commend the club to those who may not already be enrolled among its members and wish it every possible success. A suitable building has been secured and is being comfortably fitted up. Visitors to the asbestos region will find the club a most useful institution and an excellent medium for imparting reliable information regarding the mines and the resources of the district. The formal opening of the club will take place on the 24th inst.

The work of increasing the capacity of the Fertilizer Works of Messrs. G. H. Nicholls & Co. at Capelon has been commenced. A building 200 feet long by 75 feet wide, three storeys high, with an ell attached 175 feet long by 65 feet wide, is under way. For the buildings 250,000 feet of lumber will be required.

The shipments of iron ore from the Bristol Iron Mines to the United States, from 1st January this year to date, have been:

	Tons.
January	923
February	1149
March	846
April	1279

The shipments were made to the Crane Iron Co., Catsauqua, Penn.

The project of utilizing the peat of the Ste. Brigid swamp has not yet been abandoned. The experiments by the Ste. Brigid Peat company show samples of carbonized or compressed peat of the density of coal, and said to be equal to coal in heating properties. Mr. Aikman, the manager of the company, has confidence in the ultimate success of the works, and declares that manufactured peat can be turned out f.o.b. cars for \$2 per ton. Mr. Taylor, an English mining engineer, recently examined the beds and works, and gave expression to his conviction that the swamp lands of Ste. Brigid will yet prove to be of commercial value. There is a report that a syndicate will shortly be formed to push the enterprise.

Commenting upon an announcement of the meeting of the shareholders of the White's Asbestos Company called for 2nd ulto., the London *Star* has the following:—"There is to be a meeting of the shareholders to-morrow, but we are informed that it is to be of a strictly private nature." We can understand that, and the public can draw their own inference as to why the directors are unwilling to give publicity to their statements respecting the position of the Company. Exactly a year ago, when this concern was placed on the market, we called attention to certain exaggerations and mis-statements respecting the value and capacity of the properties to be acquired and we warned investors to look carefully and cautiously into the scheme before putting their money into it. We are now curious to know just exactly how much asbestos was raised from the South Garthby lots, about the value of which the promoters made so much ado in their prospectus. All is not gold that glitters, and all serpentine is not asbestos bearing is an adage the full mean-

ing of which the shareholders of the White's Company no doubt, now fully realize. It should be the endeavor of every one engaged in legitimate mining to discourage any attempts that may be made to flood the market with undeveloped and sometimes unprofitable areas, at figures which even the most profitable mines at the present time would scarcely warrant.

Ontario.

The Wright lead mines at Temiscamingue have, we have good reason to believe, been acquired by a strong New York syndicate. Mr. John Williams, M.E., of New York, is now at the mines putting the plant in order, and making arrangements for a resumption of active operations.

Just as we go to press we have received a copy of the long looked for Report of the Royal Mining Commission. We will make some extended reference to the work of the Commission in our next issue. An edition of 7,000 copies, bound in half leather, has been issued.

The manufacture of "Portland cement" from clay and marl, obtainable near Kingston, will be undertaken by Mr. Lenderoth, a German specialist thoroughly acquainted with the business, provided the necessary capital and a suitable site are obtainable. The inexhaustible supply of the best raw material, and the cheapness of manufacture, with best facilities for shipment, should be inducements to favor the project; and it is to be hoped Kingstonians will not be slow in affording the country an opportunity to buy at home so valuable an article, without sending \$200,000 a year to Britain and Belgium for this building material.

Port Arthur District.

The chief matters of interest are the proposed subsidies by the Dominion Government to the extension of the Port Arthur, Duluth and Western Railway to the gold areas in Moss Township, and to the Kakabeka Falls town site. With these branches, and the extension of the C. P.R. line to the Atikokan iron range, the output of ore from this port would assume an importance which would undoubtedly bring this section rapidly into notice as a most desirable field for investment, especially for the extent and variety of its mineral resources.

There is nothing of special moment to note in reference to successful development and output of the various silver mines. A company is now being organized here, assisted by English capital, to secure options on promising properties, and make such necessary preliminary outlay as will determine their probable value, with a view of promoting companies for the purchase and operation of such as warrant such a course. A company of this nature, composed of honorable, experienced men, would be of great service in enabling explorers and others to have their finds tested and sold—a very difficult matter when we consider that the majority of explorers are men without means. Many valuable properties which now lie dormant would spring into life.

At the Badger, two shifts are at work south of Badger mountain cross-cutting for the vein. Explorers are at work prospecting the whole of this company's property, and it is expected that the new work, in connection with the energetic developments carried on at the old workings, will make the Badger output for this year fully up to its excellent record of the past.

The Silver Glance property, north-west of Whitefish Lake, and adjacent to the Silver Fox and Mink Mountain properties, reported sold last week, is, we understand, finally secured by a French Banking Company. Your correspondent has taken silver from this vein, and seen magnificent samples of native silver, which would indicate that this French organization have secured such a property as will induce them to take hold of other claims. Work will commence almost immediately.

The new manager of the Shuniah Weachu mine—Mr. Macdonell—is daily expected out from England to take the place of Capt. Thos. Tretheway, who is moving into Port Arthur.

Several locations of manganese have been taken up lately, and, in connection with adjacent iron finds, may prove of great value. Another new metal has also been discovered, said to be a silver ore, which has puzzled the local experts. Samples have been sent to mineralogists for determination.

A new mining map of the mining districts between Port Arthur and Hunter's Island, and including the Atikokan iron region, is being prepared by Messrs. Russell & Co., Land Surveyors, Port Arthur, and will shortly be lithographed. The want of a reliable map of this region has been a serious drawback for a long time past.

The Black Bay silver lead deposits are being inspected and worked by Duluth capitalists, on option, at good figures.

The directors of the Silver Glance Company are M. Ed. Schuberth, Consul de la République de Nicaragua, 139 Cannon St., London, E.C., M. C. Kuss, of the firm Messrs. C. Kuss & Co., London, M. L. de St. Giniez, of the firm G. de St. Giniez & Co., Banking Agents, London, and Messrs. S. J. Dawson, M.P., Walpole Roland, M.E., A. R. Lewis, J. J. O'Connor and Mayor Squier, all of Port Arthur, Ont. We understand that some 550 odd shares of \$5 have been subscribed for in Port Arthur alone, and fully paid into the bank within one week of issue; and this, in a district where the chief aim is supposed to be the discovery, development and sale of mines, must be regarded as a very favorable sign in favor of the new company. The mine has been very favorably reported on by Dr. Selwyn, Walpole Roland, M.E., Capt. Tretheway, M.E., A. Falco, M.E., and others competent to judge of its value. The property is favorably situated for economic working, being about 1½ miles north of the line of the P. A. D. & W. Railway, now in course of construction. Development has given evidence of promising results. The capital of the new company is placed at £60,000.

Operations with the diamond drill have been discontinued on the property of the Beaver Mining and Milling Co. Four holes were drilled to a depth of 128 feet. The first hole struck the vein 12 feet below the surface of the rock, which at that point is 60 feet below the surface. The developments made with the diamond drill have been so satisfactory that Captain Hooper did not deem it necessary to go any deeper with it at that point. He will at once commence sinking a shaft at the junction of the two veins, and put that part of the Beaver property under active development. Some of the cores brought to the surface by the diamond drill were literally full of sulphide of silver, the average going about 40 ounces. The mill is now in readiness, and will be started in about one week, just as soon as the tramway from the mine can be put in shape. The mill will treat 25 tons per day, which, when the richness of the Beaver ore is considered, will run into large amounts per month. Capt. Hooper expects to double, and possibly treble, the capacity of the mill about the middle of summer.

Manitoba and North West.

The company which is developing the Turtle Mountain coal beds has asked the Manitoba Government for aid to build a railway from Deloraine to their mine, some fourteen miles. This coal has been recently distributed for trial and found satisfactory, and it is expected will be sold in Winnipeg from 5 dols. to 6 dols. per ton. The coal is got 45 ft. from the surface, in a five-foot seam. It is neither hard nor soft, makes no clinkers, and is a good steam coal.

Coal exists in large quantities on the shores of Hudson's Bay. On Long Island, opposite Great Whale River, 650 miles from Churchill, is an exposure of anthracite, containing by assay 94.91 per cent. of fixed carbon and only 35 per cent. of ash. It is probable that other seams of similar character are to be found on the adjoining mainland, where the stratification is similar. On the Missinaibi River, 150 miles from Moose Factory, there are no less than five exposures of lignite; and Dr. Robert Bell says:—"In the interval between one and two miles above this seam the whole bed of the river appears to be underlaid with lignite." On Melville peninsula, coal has been found on the shore in small quantities, but no exploration has been made to determine the situation and extent of the veins. Amongst other minerals discovered on Hudson's Bay, Professor Bell reports gold, silver, copper, soapstone, mica, plumbago and lead. Steam navigation is easily possible with such coal deposits available.

Messrs Geo. H. Campbell and H. E. Crawford, who have been to New York negotiating for money to build the railway from Deloraine to the Turtle Mountain coal fields, returned to Winnipeg on 10 inst. It is understood that their mission was successfully accomplished, but they will not make any of the details public for a few days.

The Alberta Coal & Railway company began operations at their Lethbridge colliery on the third shaft on the 15th of May. The other two are progressing favorably. Progress on the American side of the Alberta railway is being rapidly made.

British Columbia

The Slate Quarries at Golden are to be opened up and worked this summer. The quarry is located by the side of the railway track. The pitch of the slate is such that it can be quite readily mined and placed on the cars. Two colors of slate are found, one a light the other a dark blue. Experts pronounce it a very superior article,

equal to the best found in the east. It is expected that a market will be supplied from the Golden quarries, extending east as far as Winnipeg, and to all points on the coast. Contracts have been entered into for supplying the slates for the Catholic and Methodist churches, now under course of construction at this point, and other large buildings to be erected this year will also likely be shingled with the slate. It is expected that slate shingles will be sold at the rate of about \$8.50 per thousand in Victoria, and though they will cost more than double that of sheet iron for roofing, yet their durability will more than compensate for the extra cost of placing them in position.

Work has been resumed on the properties of the Gordon Hydraulic Company at Leech River. A large sluice, three feet wide and two feet deep, has replaced the old ditch, and there is at present ample water for piping. The company are determined to fully test the ground and feel assured that when a clean-up is made in the fall they will have good returns. When work was begun in the face of the hill last year, two days piping gave a return of \$16. If the mine proves a paying venture, other ground will also likely be worked, fully five miles of good looking ground being available. There has been considerable adverse opinion concerning probable results at Leech River. "Far off fields are greenest," and perhaps it is because Leech River is so near Victoria that so much pessimism prevails about its gold-producing character.

The Hamilton Powder Company of Montreal, with a view to a further extension of their business on the Pacific Coast, are making extensive additions to their works near Northfield.

It is expected that the Cottonwood Gold Mining Company will employ about 200 men during the summer. Work is to be prosecuted with vigor.

It is reported that the Island Mountain Quartz Company will commence crushing rock this summer in Cariboo. All the old miners are looking forward to a lively time in that section, this season.

Arrivals from the Kootenai mines state that the Canadian Pacific has about 250 men at work constructing their line from Sproat's Landing to Kootenai Lake, and which will open up all the mines near the lake. A desperate effort will be made by that corporation to get the bulk of the traffic of the ores northward, which will insure cheap transportation to the miners from the start, as competition from the south is only a matter of a few months. The Canadian Pacific people propose to have their line completed in three months.

Last week Dr. Hendryx struck his large vein at a depth of 210 feet from the surface, and at a distance of 575 feet from the mouth of the tunnel. The ore looks most promising—at least 60 per cent. lead, or a high grade of silver. This is the ledge which he cross-cut last fall a width of 86 feet. The Skyline, at a depth of 175 feet, looks better than it ever has before. The ore which has hitherto been shipped from this mine yielded in Montana over \$300 net per ton. The owners of this mine will erect a concentrator during the season. The Spokane Co., the Pearl Co., on Woodbury Creek, the Neosho Co., and a few others, are showing up good bodies of ore, and will score a point during the summer.

Information from Omnicca advises the discovery of pay ground in a creek twenty miles south-west of Vital Creek. The diggings are shallow, about two and a half feet deep, the bed-rock comparatively smooth where prospecting has been done. From three pans of dirt over ten dollars in gold was taken. It is "lead" gold of fine color, and experts state that it is worth \$18 per ounce. Chemical tests of the ground are being made.

The Hall Bros., of the Eagle Creek Gold Mining Co., have shipped 400 tons of ore to Bute and Denver, and have obtained a result of 299 oz. of silver to the ton and 30 per cent of copper.

A new mining company composed of English and American capitalists, and several residents of Vancouver has made arrangements to mine on Siwash Creek. They have purchased from the Siwash Bed Rock Flume Company the right to mine for six miles along the creek. An experienced engineer has made a careful examination of the ground and found that it was very rich. The new company which is called the Anglo-American Mining Company, will put a \$5000 plant on the ground and begin operations in a very short time. A saw mill will be erected, two steam derricks and one and a half miles of steel pipe put in.

The managers of the Great North Western Railway have finally decided to build west from Great Falls, Montana, by the northern route by way of Flathead Lake and Kootenay River. The reason the northern route has been chosen is said to be because the people connected with that road own extensive coal fields near Flathead Lake, which are yet undeveloped. This coal is of very fine quality and is known as coking coal, and exists in large quantities. This road will bring this coal to the Kootenay and Spokane smelters, and it is claimed it can be laid down at \$5 to \$6 per ton.

Report of the Committee on Mines and Minerals to the Nova Scotia Legislature.

The Committee on Mines and Minerals beg leave to submit the following report on the several matters referred to them:—

No. 1. A petition from Mr. Jas. Hemeon, of Queens County, which sets forth that in April 6, 1887, a certain Mr. N. Hammett took out a prospecting license on Malaga Barrens, Queens County, covering nine gold mining areas in which the petitioner was interested; that on the 3rd day of October of the same year, the petitioner filed an application for renewal signed by himself and a W. B. Philips, that the license was renewed to the petitioner, the name of W. B. Philips not being accepted by the Department of Mines because his transfer was not filed, that April 6, 1888, A. M. Hemeon, M.P.P., called at the mines office on behalf of the petitioner with reference to a renewal of the prospecting license, or with the object of taking them under lease in whole or in part, it does not appear which, and was informed by Mr. Carman, a clerk in the office, that they had been taken the preceding day under prospecting license by Messrs. Wade & McGuire. The petitioner further states that on one or two occasions he wrote or caused to be written letters to the Department of Mines enquiring about the areas in question, to which no answer was received. Of these illegal letters no record can be found, nor does any person in the Mines Department seem to remember anything of them. The petitioner afterwards received a letter from the Department dated Sept. 19, 1888, marked No. 1, which is appended hereto, and in October of the same year he received from the same source another letter dated October 18th, which is also appended and marked No. 2. In this letter (No. 2) he was informed that what was told A. M. Hemeon, M.P.P., April 6, 1888, to the effect that the license under which the areas in question had been held by the petitioner, had expired on the 4th April, two days before, was misleading, inasmuch as the prospecting license under which the areas were then held, did not expire until April 6th, that Messrs. Wade & McGuire did not acquire legal title, and that Mr. Hemeon, M.P.P., should have been told to come again in the following day, April 7th, when the ground would be vacant. The petitioner claims that for those reasons he was deprived of his areas, and prays that the title to them be given back to him, or an equivalent in money.

Your committee find that the prospecting license granted to Wade & McGuire was clearly illegal, and as a title, of no value whatever, and was so considered by the head of the Department of Mines, and that were it not illegal it was not renewed, but expired on October 5, 1888. The fact being that these disputed areas remained vacant from April 7, 1888 to October 18, 1888 of the same year, when they were taken by Messrs. Wade & McGuire, and are now held by them.

That though it is admitted that Mr. Hemeon, M.P.P., was misled by information tendered him by a clerk in the Mines Department, your committee, while not excusing the carelessness which induced said clerk to render such misleading information, are of opinion that the petitioner should not have been misled thereby, for he had correct information given him in the receipt he received from the department for moneys paid by him and Hammett for the prospecting license; that information was sufficient to show him when the license expired, and he should have been guided thereby. Your committee, therefore, do not consider the department of mines liable for damages for any loss which may have been sustained by the petitioner.

No. 2. Is a petition from Jas. Thompson, builder, of Halifax, and Kinsman Randolph, merchant, of Bridgetown, in which the petitioners state that on the 20th day of September, 1887, they made application for nine mining areas in Mt. Uniacke gold mining district; that October 2nd, 1888, they got a lease of said areas, that said areas were adjoining certain other areas held under lease by certain Withrow & Hartlen; that prior to the date of the lease given to the petitioners, the areas leased to Withrow & Hartlen were surveyed by B. Blois, a crown land surveyor; that when the petitioners took possession of the areas leased to them, they found the north-east corner of the areas owned by Withrow & Hartlen, marked by a stake placed there by said B. Blois, and also that the east line of Withrow & Hartlen's areas

was blazed out and cut through the woods, that there was thereby a clearly definite line of division cut and marked between the areas held by the petitioners and those leased Withrow & Hartlen.

That for the same reason that the bed rock was nearer the surface, near the said division line, the petitioners sunk a shaft over 40 feet in depth within a few feet of said division line, and afterwards sunk another shaft 70 feet deep, thirty-seven feet east from the first shaft, and fifty feet from said division line, and for purposes of ventilation, they cut a cross tunnel 37 feet in length connecting these shafts, that said shafts and tunnel were intended for permanent use.

That after the petitioners commenced work said Withrow & Co. began operations on their areas near said division line and they afterwards claimed that said line was not correctly laid down, and they then began working to the eastward thereof.

That a short time ago another survey was made by F. W. Christie, Crown land surveyor, of the areas leased by Withrow & Co., under the direction of the commissioner of mines, and by that survey it was found that the lands leased to Withrow & Co. were 39 feet short of what they were intended to be, and that the said surveyor located said north-east corner, and the eastern boundary of said Withrow & Co. areas 39 feet further east than they were previously located by B. Blois; that Withrow & Co. have taken possession of that portion of their areas, between the old and the new lines, and at the date of the petition were working the same.

That by the moving of the line the petitioners first mentioned shaft was taken from them; that the air tunnel is almost wholly on that portion taken by Withrow & Co.; that the second shaft sunk by the petitioners will be available only as an air shaft; that they will have to sink a new shaft further to the east, and that they will have to cut a new air tunnel.

That owing to the dip of the rock, the new shaft will have to be sunk to a depth of over 125 feet (125) before the petitioners can work as advantageously as they were able to do before the re-location of the division line.

That they will have to move certain buildings and plant from off that portion of the areas taken by Withrow & Co.

That their loss by reason of the change of said division line will be over \$2,400.00.

For these reasons the petitioners pray that such relief may be granted them as may be just and right, and that they may be recompensed for the loss of the piece of ground in question and their improvement thereon.

As the result of investigation your committee find that the statements of the petitioners regarding the location, removal and re-location of the boundary line between the areas held by them and those held by Withrow & Co. are substantially correct; but regarding the equity of the damages claimed, your committee are not able for reason of want of knowledge other than that afforded them by the evidence of the petitioners, to judge.

Your committee therefore recommends that the Commissioner of Mines have the alleged facts regarding the shafts, tunnel, removal of buildings and plant, also whether the petitioners have profited by gold extracted from ore mined out of said shafts and tunnel, examined by some person expert in such matters, and if it be then found that the petitioners have a *bona fide* claim for any damages, that such be awarded them.

No. 3. Is a petition from John Cameron of Melrose, in the County of Guysborough, setting forth that on the 29th of August, 1888, the petitioner obtained from the Department of Mines a prospecting license of certain gold mining areas, on the west side of Ecum Secum Harbor in the County of Halifax, for which he paid the usual fee; that on prospecting said areas he discovered a valuable lead of gold bearing quartz thereon; that thereupon he sold a one-half interest in said areas to one Peter Graham of New Glasgow, the consideration being \$200 in cash, an undertaking on the part of the said Graham to erect machinery on and invest capital in the development of said areas, one-half of the profits of the venture to accrue to the petitioner; that the petitioner also sold to one David Smith, for services valued at \$100; a one-tenth interest in said areas to one Donald McLean; a one-twentieth interest for \$25 to one Thomas Campbell; a one-twentieth for \$40, and to the aforementioned Graham a further one-tenth interest for certain services rendered in connection with said areas.

That on the 8th day of February, 1889, the petitioner obtained a renewal of said prospecting license.

That while the company so formed were proceeding with the development of said areas and on or about the 10th day of May, 1889, the petitioner was informed by the Inspector of Mines, Mr. Gilpin, that the areas enumerated on said prospecting license were held under lease by a certain company known as the Pittsburg Co., that the said Pittsburg Co. soon afterwards transferred their lease to a certain firm composed of John Yorston of Pictou, and the aforementioned Peter Graham, who dispossessed the petitioner.

That the petitioner claims that he is entitled to be paid by the Commissioner of Mines, as follows:—

To cash paid for license and renewal.	\$ 15 00
" " claimed from petitioner by P. Graham.	200 00
" " " " Smith.	100 00
" " " " McLean.	25 00
" " " " Campbell.	40 00
" 10 days measuring and prospecting, etc., at \$2.00.	20 00
" Coach hire from Sherbrooke to Ecum Secum.	6 00
" Supplies and Sundries.	10 00
" Damages for the loss of one-fifth interest by petitioner.	2,000 00
	\$2,416 00

That on the 13th day of November, 1889, the petitioner petitioned the Governor-in-Council for relief, and craved, in the event of such relief being refused, to be permitted to prosecute an action in the Supreme Court of the Province against the Hon. Commissioner of Mines therefor, when thereupon, the petitioner was directed to bring his claim by petition to the notice of the Legislature; the petitioner therefore prays for such relief and damages as in the nature of his case may seem meet.

Your committee upon investigation have found that the alleged facts of the petitioner having obtained the said prospecting license; of his having transferred certain portions of the areas covered thereby to the persons named in the petition; of the areas having been at the time, without the petitioner's knowledge, held under lease by the aforementioned Pittsburg Co.; of the lease being transferred by the said Pittsburg Co. to the aforementioned John Yorston; of the petitioner being dispossessed by the said John Yorston; and of the petitioner having suffered loss by being deprived of the title, were substantiated by evidence tendered during said investigation. Your committee therefore, inasmuch as the petitioner was misled by reports from the Mines Department, and was in consequence put to considerable expense and loss of time, and was also deprived of valuable property which he had reasonable excuse to suppose was his own, recommend that he be paid by the Province the sum of five hundred dollars, said sum of five hundred dollars to include the monies paid by him for licenses and renewals thereof.

Your committee also beg leave to report that during the investigation concerning the petition of John Cameron, aforesaid, it came to their notice, and was afterwards found to be true, that Mr. Carman, a clerk in the Mines Department, had been acting as agent for the said Pittsburg Co.; that as such agent he promised the transfer of certain areas at Ecum Secum, among them being those given under the said prospecting license to the petitioner to the said John Yorston; and that it was on account of misleading data furnished by the said clerk that the said areas were given to the petitioner in the first instance, and that from a letter written by the said clerk to John Yorston, which was produced and read before your committee, it appeared that the said clerk was at once misleading the Department of Mines and the Pittsburg Co., for one of which he was confidential clerk and for the other he was acting as agent.

Your committee deeply regret to find a person employed in such an important department as that of Mines, and in which he is a very prominent official, acting in a double capacity; they therefore deem it their duty to bring the matter to the notice of the Legislature, and also to that of the Government.

In view of the large and rapidly increasing amount of important business coming daily before the Department of Mines and Public Works, and in view of the mistakes that, perhaps necessarily, occur on account of such increased business, your committee take the liberty of recommending that the Department of Public Works be separated from that of mines, and that each be placed under a distinct departmental head, or, if such is impracticable, that the PUBLIC WORKS be placed under a DEPUTY HEAD, and that it then be transferred to one of the other departments, either that of the Attorney-General or that of the Provincial Secretary.

All of which with the papers connected therewith are respectfully submitted.

JAMES A. FRASER.
T. R. BLACK.
R. L. BLACK.
Committee. ALLAN HALEY.
JEFFERY MCCALL.
DANIEL MCNEIL.
WM. MCKAY.

I agree with the above report with the exception of the recommendation in reference to the Department of Public Works and Mines. (Sgd.) WM. MCKAY.

At a miner's meeting at Revelstoke, on the 19th inst., the Premier confessed that his policy of granting power to railway companies to collect a royalty of 50 per cent. on minerals found on their lands imposed a hardship upon the miners which ought not to be. He stated that he now had information which he did not have before, and he should not lay a straw on the back of the prospector saying "I can see how badly it works, and that it will seriously retard mining in the Railway Belt." He promised to have the matter adjusted.

transferred to the Pension Fund, all the remainder was left subject to their discretion, and independent of the offer of 2 per cent. of salary made by the Company.

Reward Fund.—Every year, grants are made to workmen distinguished for length of service, punctuality, civility and good conduct. These rewards are made in about the proportion of one-tenth of the salary.

The account of the donations of the Coal Mining Company of Bessèges in 1888 reached the sum of \$69,000, equal to \$28.59 for each workman.

The Annual Meeting of the Canadian Phosphate Co. (Limited).

The annual general meeting of the shareholders of the Canadian Phosphate Company (limited) was held at London, 26th ultimo. Mr. Edward Packard, jr. (the chairman) presiding. The following is an excerpt from the report for 12 months ending November, 1889, submitted to the shareholders:—

"In presenting the following report for the year ending November 30th, 1889, the Directors regret that although the output for the past year is about 50 per cent. larger than that of the previous one, the accounts do not show a corresponding profit. On the other hand, however, a large amount of development and prospecting has been carried on, of which but a small part has been charged to capital account, and the mine has now been placed in proper working order.

"The exact quantity of ore produced during the twelve months was 6,560 tons of uncobbed ore, as compared with 4,036 produced during the eleven months ending November 30th, 1888, and the shipments to the U.S.A., Canada and Europe, during the same period, amount to 5,710 tons. Nearly 2,000 tons sold for shipment during 1889 had to be held over, owing to the scarcity of tonnage in Montreal caused by the London Dock strike.

"The main working of the old company, viz. the Big Pit at Star Hill, proving too expensive had to be abandoned last April, much to the regret of the directors, seeing that in past years very large quantities of ore had been produced therefrom at a low cost. Another old working, namely, the Bridge Pit, was pumped out and proved very remunerative, thus partly recouping the company for the loss sustained in working the Big Pit.

"Four new pits have been opened, viz., Nos. 1, 2, 4, and 6, all of which are working, with the exception of No. 1, where work has been suspended during the winter months, as the pit is entirely open and unprotected.

"The Crown Hill Mine has been fairly productive, but the ore produced having been very soft, the proportion of second quality has been much larger than was anticipated, and the falling off in profits is attributable to this. This has been especially the case with Pit No. 18, which was opened in May, and produced nearly 1,000 tons of ore before November 30th.

"The mill situated at Buckingham on a siding of the Canadian Pacific Railway has been doing good work, but the plant is insufficient at present to deal with the quantities of mill stuff produced at the mines, and a considerable part of this material has been ground at a neighboring mill. The consumption for ground low grade ore in the U.S.A. and Canada is increasing rapidly, and new contracts have been entered into at higher figures.

"The prices ruling for phosphate during 1889 were about the same as during the previous year, but since the autumn the market and demand for phosphates has expanded very materially, and the price is now from 20 to 40 per cent. higher, according to quality, and likely to remain so, owing to the scarcity of high test phosphate.

"During the last six months of 1889 the directors have been enabled to introduce some important economies in the management and working at the mines, which are now giving a much better profit, and they feel confident in being able to show a great improvement in this year's results.

THE CHAIRMAN said: Thereport is so full as regards the work that has been carried on by the company during the past year, that I do not know that any very lengthy comments are at all necessary upon it. The directors feel a considerable amount of regret that they are not able to propose that we should pay a dividend this year; but we have had a great many circumstances to contend against which were certainly unexpected, and which have militated against the successful operation of our company at the mines. One does not like to cast any reflection upon our servants, or any of those who have been in our employ, nor do I desire to do so, but I must say that I hope the difficulties which we have experienced have not been assisted to any great extent by the managers which we have employed up to the present. I may say that I feel pretty confident that the arrangements which have now been made will result in much more satisfactory work, a much more satisfactory output of phosphate, and a much more satisfactory result as regards the cost of getting that phosphate. We all know that mining operations are uncertain in their action, and that

is the only certain thing which is known about mining operations. There may be, when we open up our deposits, something very profitable to work out, or it may mean that there is a considerable expenditure compared with the actual amount of phosphate produced. That the mines have been productive is proved by the statement in the report that no less than 5,710 tons have been shipped. I think we exported during last year just about one-fifth of the total export of phosphate from Canada, and I think the total export is something like 27,000 tons. As regards the demand for phosphate, there is no doubt that at the present time it is exceedingly satisfactory, especially for the class of phosphate which we have been enabled to produce. There seems to be no doubt that we shall be able to sell any quantity that our mines may turn out, and at a remunerative rate in future, as the demand is very considerable. The phosphate that we produce is, I think, in more demand than any other kind of phosphate at the present moment, and we must find a ready sale both in this country and elsewhere. We state in the report that the prices have improved. We are looking for a much better and more profitable return in the future. To what extent we can succeed in increasing the output of the mines very much depends upon the point to which I have alluded—whether we are successful or not in hitting this vein of phosphate which will be more or less productive. If anyone is particularly interested in it, and they will refer to the plan which has been made, which indicates all the workings at present going on, they will see how very important is this property. If we can succeed in decreasing the cost of output and increasing the price of material which we turn out, we shall have a much more successful time in the future than we have had in the past. I do not think it necessary for me to say very much further, except to assure the shareholders of the very great attention that the directors have been giving to the affairs of the company. The thanks of the shareholders are especially due to Mr. Millar, who has given up a considerable amount of his time in visiting the property, and who has made arrangements which, I am sure, will be very conducive to the future improvement of our position. He will be able to tell you more than I can as to the actual position of matters at the mines, because he has been there, and has taken an active part in seeing the work that is going on; so I think I must refer to him for any statement that can be made with reference to the actual work, and the methods employed in carrying it out. I beg now to move the reception and adoption of the report and balance-sheet.

MR. C. C. HOYER MILLAR, in seconding the adoption of the report and balance-sheet for last year, said: I may be able, owing to my personal knowledge of the mines, to speak rather more fully, perhaps, than your chairman about the causes of delay in getting the company into a dividend-paying state. At the time of my first visit to the mines, during January two years ago, I was unable owing to the depth of snow, to see more of your property than the three pits actually being worked at that time. It was apparent, however, that the late company, owing, no doubt, to their knowledge of the formation of the present company, had not been carrying on the work in a systematic manner. The result of this has been that the present company was considerably handicapped at the start. It must also be borne in mind that your company is really carrying on two separate mining undertakings, one at Star Hill and one at Crown Hill. At the latter place work had only been started some six months, and the first year of this company's time was mostly occupied with putting up the buildings, fixing the plant, and laying down the tramway, and it was only last year that the mining operations there began to take proper shape. I visited the mines again last October, and made a thorough investigation of your property, and the results of my examination were most satisfactory. I also visited all the other mines in the same district, and I may say that your property can compare most favourably with any of them. A considerable amount of developing and prospecting has been carried on simultaneously with the mining operations, and the company is now well situated for producing good future results, as many showings have been discovered, and have been partially opened up, and which can be worked to advantage as opportunity occurs. It must be remembered that the Canadian phosphate mining industry, though it has been carried on for more than 15 years in a desultory kind of manner, is still in its infancy, and it is only during the last few years that any systematic methods have been followed, and some of our neighbours have recently pumped out old pits abandoned years ago, as at that time they had not the necessary machinery for working at a depth. Improved machinery and greater continuity of working are being adopted at the present time, the results of which are apparent in the increased outputs from the larger mines, and much less ore is now wasted than was the case during the earlier mining operations. Your directors have had some unforeseen difficulties to contend with, the most important of which has been the difference of the way in which phosphate has occurred in many of our new pits, and what

was formerly thought to be the rule has proved to be the exception, by which I mean to say that one cannot expect in Canadian phosphate mining to be continually coming across large bonanza deposits of apatite, though such do occur from time to time; but that the true calculation is that by moving so many tons of rock one can reckon, on an average, on so many tons of ore. When extracting from large pockets, the phosphate comes out clean and free from impurities; but when the leads narrow down or get intermixed with feldspar, calcite, or mica, the proportion of high testing phosphate will be smaller and much more expensive to cob. We made a good many experiments with this mixed phosphate before we could determine the best method of treating the same, but I am glad to say that we have at last arrived at a process which considerably improves the quality. Had it not been for the large quantity of second and third qualities produced, the profit and loss account would have shown surprisingly different figures.

Turning now to the question of the transport arrangements over which your company has control, I may say that the same are most complete. The tramway at Crown Hill, from cobbing-house to the Du Lièvre River, is a great success for the economic and rapid loading of the scows. On the river we have our own steamer and four scows, and at Buckingham Landing we use steam hoisting apparatus for discharging from the scows into the railway cars. There are certain difficulties at the Little Rapids during the low water in the summer months; but thanks to the excellent arrangements we have been able to make with our neighbours for towage on the river and the loading at Buckingham, we have been able to reduce the anticipated trouble to a minimum; and I take this opportunity of thanking Mr. Hilton Green, of Montreal, and Mr. Walter Pickford, of the High Rock Mine, for joining hands with us over these arrangements. The mill at Buckingham has been steadily grinding the third-class quality, but owing to the excessive production we had considerable quantities ground at the neighbouring mills, and we have just concluded negotiations for a further quantity to be ground over the next 12 months. The demand for this ground phosphate in Canada and the United States is steadily increasing, and we are now getting prices nearly 20 per cent. higher than those of two years ago. I may mention that we had at the mines a large pile of what we call debris, i.e., phosphate mixed with rock in such a shape as to make it impossible to be cobbled, but that we have now been able to turn same to account by the installation of a Blake crusher, and the results are much better than was anticipated, so much so the stock valuation of this pile on November 30 will be increased on realisation by some £800. As regards the general system of work at the mines, there are some alterations that I should very much like to see carried out in the way of more permanent and fixed machinery; but until our financial position is improved your directors cannot see their way to increase the capital expenditure. Your profit and loss account for last year is certainly disappointing, but I may mention that during the first year's working we received about £2,000 under an arrangement made with the former company, and that the freights for last year cost the company nearly £1,000 more than was anticipated. It was during the months from December, 1888, to June, 1889, that the mining operations were unsuccessful. I calculate that about £3,000 was lost in those six months. The last six month's working, however, made up this loss and showed a few hundred pounds to the good. As regards future prospects, I think the company has all in its favour. The expenses of management have been greatly reduced, and the cost of extraction is considerably lower. The production since December 1 to date has increased about 15 per cent. on the corresponding period of the previous year, and the wages sheet, which is the heaviest item in the accounts, shows a reduction of 10 per cent. In addition to this, I am most pleased to be able to report that the quality of the ore has improved, and we are now getting a higher proportion of first quality, with a corresponding decrease in the production of the mill stuff. This point is really the most important of all, for the mill stuff does not pay the cost of extraction, and on last year's prices there was next to no profit on the second quality, so that it is really the 80 per cent quality which has to earn the dividends. Prices are very materially higher and freights are lower, so that I do not doubt but that this year we shall be able to make some return to the shareholders, who may rest assured that the directors have done, and will continue to do, their best to make the undertaking profitable.

The motion was then put and carried unanimously, without discussion.

Mr. Millar proposed the re-election of Mr. W. H. Williams as director of the company, which was seconded by Mr. Foly and carried.

On the motion of Mr. Winkfield, Messrs. Hibberd, Bull and Co. were re-elected auditors of the company.

Mr. Winkfield then proposed a vote of thanks to the chairman, which was seconded and carried.

The chairman briefly acknowledged the compliment, which closed the meeting.

Meeting of the Excelsior Copper Company (Limited)

At the annual meeting of the Excelsior Copper Company, Limited, held on Tuesday, 22nd ultimo, the chairman, Colonel Malleon, stated that the expenses of the mine amounted to £7,689, while the sum actually realised in England was £1,165, in addition to which they had on the dumps—on the ground—ore estimated at £10,000, the result being a profit of about £3,000. At the conclusion of the chairman's remarks, the secretary, Mr. Fenwick, read the report of Captain Davey, which dealt in an exhaustive manner with the work done at the mine, and subsequently Captain Davey himself addressed the meeting with regard to the present position of the property. During the year he said that they had raised 20,000 tons of schist ore, and from thirteen assays that had been made the lowest yield was 3.90 per cent. and the highest 9 per cent. They had already sent to England about 100,000 tons, which had realised at Swansea from 8 to 9 per cent. They had hundreds of thousands of tons of this schist ore, and he guaranteed what they had on the dumps would give a profit of £10,000. With regard to the better class of ore, he said that would give them 35 to 60 per cent., and they had got that in pockets of 10, 20, 30 and sometimes 50 tons. On the conclusion of the ordinary meeting a special court was held to consider the following resolution, which was carried:—That for the purpose of, and to enable the directors to further develop the property of, the Company, may be, and are hereby, authorized to raise the sum of £20,000 by the issue of debentures secured on the property and plant of the Company, bearing interest at the rate of 7 per cent. per annum, payable half-yearly."

THE CHAIRMAN, answering a question, said the directors had not received £2,054 12s. 2d. for their fees. The amount stated in the balance sheet was an amount put there by the auditors as a matter of account, because the directors were entitled to that amount. During the last seven months, however, the directors had not drawn a single farthing.

A SHAREHOLDER.—What was the money subscribed by the public? I was told it was about £8,000.

THE CHAIRMAN.—It was £8,000.

A SHAREHOLDER.—Seeing that £150,000 was wanted, I think £8,000 is too small a sum for the directors to go to allotment on. (Applause.)

THE CHAIRMAN.—I would ask the shareholders to reserve their cheers until I explain to you how the directors were perfectly justified in going into allotment on that sum. Out of an expenditure of £7,689 we have realised an amount which is tantamount to £11,065, and if it had not been for untoward circumstances we should have been in a better position, I am in a position to prove to you and to give you the opinions of experts, that we were perfectly justified in going into allotment on £8,000. I beg to call your attention to that paragraph in the prospectus where the vendor states that he had such confidence in the mine that he was willing to take full payment in shares.

A SHAREHOLDER asked who was the original vendor of the company.

MR. GREENSHIELDS.—I am the original vendor and I shall be pleased to answer any questions you may put. I have not sold one single share. (Applause.)

A SHAREHOLDER.—You asked an exorbitant price for the property?

MR. GREENSHIELDS.—That is a matter of opinion. If a dividend had been paid at the beginning of the year, you would not say it was an exorbitant price. These things are to be shown by their results.

THE CHAIRMAN.—I think you do not realise the fact that mining is a speculation. I venture to state you can point to no mine which has been in a better state in the first year of its work than this is. The balance sheet shows it has actually realised more money than has been expended on it.

A SHAREHOLDER.—It has not been realized.

THE CHAIRMAN.—It is virtually realized. The stuff is at the mine.

A SHAREHOLDER.—Can you declare a dividend?

THE CHAIRMAN.—I cannot, but let me tell you one thing. All the directors of this Board are original shareholders. The collective directors hold a larger number of shares, probably, than any other shareholder. Shares which they bought at par value, and which they intend to make worth ten times the amount.

MR. RAWCLIFFE.—May I ask to what circumstances the directors owe this state of affairs?

THE CHAIRMAN.—What state of affairs?

MR. RAWCLIFFE.—Not carrying out the promises in the prospectus.

THE CHAIRMAN.—I will leave Colonel Gay to answer that.

COLONEL GAY said soon after the company was started the price of copper went down very much. It kept on going down. It then became a question as to whether it would be well to go on shipping the ore, or wait for better times. It was thought advisable to go on and get out more copper, with the idea that the price of copper would augment. It did augment to a certain extent, but it never came to the price to pay to send it. If they had more money they could have gone on smelting, and they would have had more copper in England than in Canada. They had no more money, therefore they could not do it.

CAPTAIN DAVEY, in addressing the meeting, said so valuable was the mine that if he had the money he would most gladly purchase. But the shareholders must be sure of this. If they did not choose to work it, those on the other side would, and be only too glad of the chance. It would not remain idle very long. He had seen a great many copper mines, but he had never been struck with a property as he had been with this. (Applause.)

THE CHAIRMAN'S motion was then put to the meeting and carried with one dissentient.

The retiring auditors were re-elected.

An extraordinary general meeting was then held for the purpose of considering the following resolution:—

"That for the purpose of and to enable the directors to further develop the property of the company, they be and are hereby authorized to raise the sum of £20,000 by the issue of debentures secured on the property and plant of the company, bearing interest at the rate of 7 per cent. per annum, payable half-yearly."

THE CHAIRMAN said this was a matter on which the future of the mine depended. They wanted money for the development of the mine. He would ask the two gentlemen from Canada to give the meeting the benefit of their opinions.

MR. GREENSHIELDS said that he had visited the mine on two or three occasions, and he was satisfied that with proper and economical working the mine could be made to pay. It was for that reason that he, when the property was put upon the market, accepted and agreed to take, if necessary, his entire consideration price in fully paid up shares. He had not sold any of his shares except the shares he parted with to his friends to provide the working capital for the mine for the last few months. So far as he and his friends were concerned they were ready to subscribe 30,000 or 50,000 shares for the development of the property, because they believed that by the expenditure of more money to strike this ore, which had been spoken of by Captain Davey, they could make the mine a success. He did not wish that this property should fall into the hands of American investors, but that the English shareholders would carry it on and reap the rewards. The property they possessed consisted of some 4,000 acres of land, which covered a valley and two mountains on either side. The range of mountains running through the country was proved to possess large mineral deposits. What they desire to do was to purchase a diamond drill in order to test the property. With that drill they could go down 1,000 feet. They proposed to go to the bottom of the Kent shaft and sink 1,000 feet, and sink another hole at the bottom of the Sayles shaft, which could be done at a comparatively small expense. He had faith in the mine, and believed it would prove a success.

MR. ROOME also expressed his absolute faith in the property. He had, himself, consulted several experts and they had all come to the conclusion that the company had a valuable mine. It was, however, necessary to sink lower and this they intended to do by means of a diamond drill. For there were very rich deposits of ore below, and it was absolutely necessary to get at them.

On the motion of the Chairman, seconded by Mr. Greenshields, the resolution was carried with but one dissentient.

The usual vote of thanks brought the meeting to a close.

Iron Ore in Newfoundland.—A correspondent, writing from Bay St. George, Newfoundland, states: "On the south side of this very beautiful bay there is a large and rich deposit of iron ore. It is seven miles and a quarter from a good harbor. It is estimated that there is about a half a million tons in sight which can be mined, or, in fact, quarried at a cost of not over 20 cents per ton. A deep ravine cutting through this mountain of ore exposes it on both sides, and affords facilities for its being easily worked. Analysis by Professor Pike shows the ore to contain 65.5 per cent. of metallic iron, equivalent to a composition of pure magnetic iron ore of 70.3 per cent.; silica in the sample showed 5 per cent., and sulphur and phosphorus none, and titanic acid 4 per cent. The proposed railway which is now being constructed to Hall's Bay, on the east coast will, when finished from Hall's Bay to Bay St. George, run within four miles of this mountain of ore. I may further add that coal fields have been discovered in the same neighborhood and are likely to be worked the coming summer. It is high time that the mining resources of this colony were more extensively opened up."

Report of the Commission upon the Mineral Resources of Ontario.

The Commissioners appointed to enquire into and report upon the mineral resources of the Province, and measures for their development, have to state for the information of your Honor, that at their first meeting held in the city of Toronto, after conferring with the members of your Government on the nature and scope of their duties under the terms of the Commission, the following scheme or plan of enquiry was agreed to, viz.:

i. The geology of the Province, with special reference to its economic minerals: assigned to Dr. Bell.

ii. Detailed description and maps of the working mines and important undeveloped mineral occurrences of the Provinces, together with all matters which appertain to mining engineering: assigned to Mr. Merritt.

iii. Trade in mineral products, showing exports and imports, shipping facility for ores, building stones, etc., and a general enquiry into the causes of depression in the mining industry of the country; assigned to the Chairman.

iv. Information and suggestions on the subject of mining laws and regulation, with a view to the giving of greater encouragement to our mining industry: assigned to the Secretary.

v. An enquiry into the best means of promoting the metallurgical industry, with special reference to the smelting of iron and other ores: assigned to the Secretary.

vi. Other measures for the aid and encouragement of the mining and metallurgical industries, embracing: (1) The organization of a bureau of mines for the Province; (2) The founding of a geological and mineralogical museum; (3) The collection and publication of mining statistics; (4) Technical instruction in its relation to mining and metallurgy. The first of these subjects was assigned to Dr. Bell, the second to Mr. Merritt, and the third and fourth to the Secretary.

It was also agreed to as part of the scheme of the report that the evidence of witnesses should be arranged, as far as practicable, under the foregoing heads, so that each subject or section should be complete in itself, and that the distinctive features of the evidence of each witness might appear in their natural and appropriate relation.

Sessions of the Commission for hearing evidence were held at thirty-seven places in the Province, from Ottawa in the east to Rat Portage in the West, and one hundred and sixty-four witnesses were examined under oath, comprising among their number explorers, prospectors, miners, mine and quarry owners, mine captains and superintendents, mine brokers, mining engineers, civil engineers, land surveyors, geologists, assayers, chemists, metallurgists, scientists, iron founders, brick makers, tile, terra cotta and pipe manufacturers, iron makers, copper and nickel smelters, mechanics, lawyers, bankers, merchants, capitalists and speculators. Mines, mining locations and works in the vicinity of places where the Commission met were examined, and careful enquiry respecting them was made.

Several other important districts and places were also visited by members of the Commission, with the object of procuring special or desirable information. The extensive magnetic iron ore range in the region west of Lac-des-milles-lacs and the Black Bay lead region on Lake Superior were explored by Dr. Bell, while Mr. Coe, Mr. Merritt and the Secretary made a journey to the iron ranges in northern Minnesota, near the Ontario boundary. Mr. Merritt also visited the Michigan School of Mines at Houghton. The Chairman and Secretary in the latter part of 1888 visited the Columbia School of Mines in New York, the office of the Geological Survey at Washington, and furnaces and steel works at Pittsburgh, Pa., at Chattanooga, Tenn., and at Birmingham, Alabama. Another object of the visit to Birmingham was to enquire into the merits and witness the operation of the Henderson process for eliminating sulphur and phosphorus from iron and converting it into steel. An accident to the machinery prevented their observing this process, but they were fortunate in arranging for a careful test and report upon it to be made by Mr. Garlick, of Cleveland, Ohio, a metallurgist whose experience in the manufacture of iron extends over a period of twenty-five years. His report appears in the Appendix. The secretary also visited, during the summer of 1889, the laboratory of Mr. Edison at Orange, N. J., to witness the operation of an electrical machine invented to purify and concentrate magnetic iron ores, the Sheffield Scientific School at Yale College, and several iron furnaces and mines in the vicinity of Port Henry on Lake Champlain.

The data of the report are original and historical. The Commission has not followed in the footsteps of others, but has pursued the course marked out for itself, and it professes to present no inference, opinion or statement of fact which is not warranted by the evidence, the study and observation of its members, or the testimony of the highest authorities.

In the Section devoted to the geology of the Province a systematic account is given of each one of its rock formations. This part of the report could not be prepared

without employing geological terms, but the simplest expressions have been used, and a glossary of many terms has been appended in order that it may be the more easily read by persons unfamiliar with geological science. To make the description more complete and intelligible, it has been deemed necessary to sketch some of the general geological features of North America beyond the borders of Ontario and to touch upon a few of the leading characters in connection with its geology. The aim throughout has been to make a statement of facts only, disregarding everything of a purely theoretical character. This section has been written with the advantages of a full knowledge of the work of the Canadian Geological Survey from its inception up to the present time, and it embodies the results of the latest researches not only of members of that service but of various other investigators. In its preparation advantage has also been taken of any new or hitherto unpublished information known to the writer.

The reports of the Geological Survey of Canada, although of much value for reference as to details in the various Provinces, are too numerous and too voluminous for the use of any one who can spare only time to acquire a general acquaintance with the geology of his own Province. Moreover, as these reports extend back through a period of nearly half a century, most of them are inaccessible to the public, and much of what was stated in the earlier volumes has been superseded, modified or largely supplemented by more recent investigations. The limits of the Province having been recently extended far beyond those which were formerly recognized, any previous account of its geology would now be incomplete, even if the data in reference to the added territory had been available. But no pretence is made to cover the field in this work. A full account of every branch of the subject, or of any locality, has not been attempted; that would occupy several volumes, and the aim of the Commission has been to present in compact form information upon all matters coming within the scope of its enquiry. The Geological Section, however, embraces the most recent and the best established views on all points, and gives prominence to the Archean rocks, which cover the greater part of Ontario as now bounded, and which are important from the occurrence in them of various economic minerals in the Huronian and Upper Laurentian systems. The description of the various formations of the Cambrian, Silurian and Devonian systems is briefer, the fullest account being reserved for those which are richest in mineral. Such are the Animikie, yielding silver ore; the Nipigon, in which native copper occurs; the Trenton, which produces petroleum and natural gas; and the Onondaga, which holds the beds of salt and gypsum.

The classification of rocks which has been followed is that of the late Sir William Logan, the accomplished founder and for twenty-seven years the director of the Geological Survey of Canada. The geology of the mining districts is described in greater detail than that of other parts of the Province, and the geological relations of some of the principal mineral products are given as examples to illustrate their general character in the districts referred to. Additional facts on these subjects are mentioned in the section on mines, especially on the occurrence of iron ores and phosphate of lime in the eastern part of the Province, and much new information available for these purposes has been collected by the Commission or supplied by the testimony of witnesses. A supplementary account of the geology of the Sudbury district and of the mining operations there, brought down to the month of October, 1889, is given in the Appendix.

A practical business basis has now been reached in the development of a number of our minerals, as for example in the production of salt, petroleum, phosphate, mica, cement, gypsum and building stones, and in the manufacture of bricks, terra cotta, tile and sewer pipe. The silver and copper and nickle mines are also being worked with much skill and energy, and at the few locations where deep shafts have been sunk and galleries have been driven the existence of large ore bodies has been demonstrated. Iron mining has been intermittent hitherto, but its operations will doubtless assume a permanent place as a source of one of our largest mineral products when we shall have the steady demand of a home market to provide for, beside such foreign markets as we may be able to secure. It may also be confidently hoped that gold mining will become one of the established industries of the country, especially if attention be given to our refractory ores and should the economic treatment of them be satisfactorily solved.

The cost of mining machinery, much of which is not yet made in Canada, is a matter of common complaint with mine owners, as is also the high freight charges on machinery, supplies and ore; but these are losses of advantage which the enlightened good sense and liberality of our Governments and our railway companies may be expected to overcome. In no other way can a country add more directly to its wealth than by raising and utilising its minerals, assuming it to possess them in commercial quantities; for not only are manufacturing industries of many kinds created to treat them, but the raw material may itself be said to be created by the labor expended in

searching for and mining it. Whatever lessons the cost of raising minerals and whatever facilities their shipment to the best markets are the most obvious means of aiding the industry; and in so far as governments can remove burdens imposed on themselves, or reduce the cost of carriage by building or granting aid to build roads or railways, they to that extent make the success of mining operations possible.

Explorers and prospectors are the pioneers of mining enterprise. They have already proven that our Province contains almost all of the economic minerals in workable quantities except coal, and that it has vast possibilities of mineral wealth. Yet the tolls upon trade and the want of facilities for cheap transportation are a hindrance so serious to the employment of capital that a number of the most promising of known mineral properties are either lying idle or are being worked in the face of great odds. Encouragement of the industry, not its discouragement, is the office and duty of the governments. Explorers, prospectors and miners deserve just consideration and liberal treatment. Mineral lands should be held for development, not for speculation. Mining enterprises should not be weighted with restrictions imposed by trade policies, and should as far as possible consistently with a fair consideration of the claims of all other interests of our country be secured the advantages of the home markets. Confidence in mining as a business should be established by yearly reports of progress made and work done. To instruct, to inform, to ascertain and publish facts, to lighten the industry, to enlighten the men employed in it and deal with them in a generous spirit—such, in the opinion of the Commissioners, is the true national policy for governments to pursue in promoting the development of our mineral resources.

The evidence that Ontario possesses great mineral wealth is abundant, and is constantly accumulating. In the central and eastern counties are magnetic and hematitic iron ores, gold, galena, plumbago, arsenic, mica, fibrous serpentine, apatite, granite, marble and freestone. In the Sudbury district copper and nickel mines are being worked on a large scale. In the township of Denison rich specimens of gold-bearing quartz and extensive deposits of copper and nickel are found. Along the north shore of Lake Huron, from the mouth of the French river to Sault Ste. Marie, gold and silver-bearing veins, iron, copper, galena and immense quarries of marble have been discovered. North of the height of land and extending towards James Bay prospectors report a promising mineral region. North of Lake Superior locations of gold, silver, copper, iron, galena, plumbago and zinc ores have been taken up, besides which there are inexhaustible supplies of granite, marble, serpentine and sandstone. West of Port Arthur is a silver district which, judging from the explorations already made, promises to be an argentiferous region of great richness. Beyond this district, to the northwest, are found veins of gold-bearing quartz and extensive ranges of magnetic iron ore, while to the southwest is believed to be a continuation of the Vermillion iron range of northern Minnesota. The partial examination already made inspires the hope that here will in time be developed an iron region of great value. Upon Sultana island and other islands in the Lake-of-the-Woods, and in the region adjacent to that lake, gold-bearing veins of good promise have been discovered, and now that the question of title has been settled an early development of some of the properties may be looked for. But knowledge of the extent of our resources is necessarily imperfect. The area of the Province is vast, many districts have not been prospected at all, and therefore it may be reasonably presumed that only an inconsiderable portion of our mineral wealth is yet known to us.

But notwithstanding the extent and variety of our mineral resources, the statistics and tables presented in Section III show conclusively that in Ontario as well as elsewhere in the Dominion the mining industry is making slow progress. The value of the metallic and non-metallic mineral products of Canada for 1887 was \$11,896,793, whereas the value of the same class of products in the United States in that year was \$542,284,225, being nearly four times greater in the latter than in the former country per head of population.*

The United States is the principal customer of Canada for products of the mine, the value of our exports to that country for the seven fiscal years 1881 to 1887 being \$18,567,710, while to all the rest of the world it was only \$4,828,313. The value of the mineral exports of Ontario alone to the United States for the twenty fiscal years 1869 to 1888 was \$14,329,330, and to all the rest of the world it was \$3,342,894. These figures present

in a striking light the natural commercial affinity which exists between the two great Anglo-Saxon divisions of the continent, and open a field of speculative enquiry as to what might have been the volume of the business if trade restrictions had not clogged its movement. The great store of ores and structural materials possessed by Canada and the transportation facilities by land and water for placing them upon the markets of the United States could not fail to build up a trade of immense extent in mine and quarry products but for the duties which have served in a more or less perfect degree the purpose of preventing commercial intercourse.

Everywhere among men interested in mining operations, with the exception of those engaged in producing and refining petroleum, the Commissioners have met with expressions of an earnest desire to see the American markets opened to the admission of Canadian minerals free of duty upon terms equally fair to both countries. The amount of iron ore exported from Canada for the fiscal year 1888 was 13,544 tons, valued at \$39,595, all but ten tons of which was mined in Ontario and exported to the United States. For the calendar year 1888 the shipment of iron ore from the lake Superior mines of Michigan, Wisconsin, and Minnesota to lake Erie ports amounted to 5,023,279 long tons, or three hundred and seventy-five times as much as the entire export from Canada. This ore was worth \$15,000,000 at the ports of shipment; about \$6,000,000 was earned by the lake marine in its transportation to lake Erie ports, and a large but unknown amount by the railway companies over whose lines it was carried to furnaces at Pittsburg and elsewhere. For the calendar year 1889 the total output of the lake Superior mines was 7,292,754 tons, showing an increase in ten years of 5,917,063 tons, or 430 per cent. Ontario undoubtedly possesses large quantities of iron ore that might be delivered at all the furnaces of Ohio, Pennsylvania and New York as cheaply except for the duty as the ores of lake Superior, but her mines are almost absolutely idle.

The increase in the world's production of iron from 1800 to 1888 has been nearly thirty-fold, it having grown from 825,000 tons in the former to 23,194,500 tons in the latter year. Of the product of 1888 Great Britain furnished 34 per cent. and the United States 28 per cent. The world's product of steel for the same year was 9,630,477 tons, and of this amount Great Britain furnished 35½ per cent. and the United States 30 per cent. Yet in the vast movement of industrial forces connected with the manufacture of iron and steel, over three-fifths of which centres in Great Britain and the United States, Canada has relatively an insignificant part, its total amount of wrought and puddled iron in the calendar year 1887 being only 31,501 tons and of steel 7,326 tons, while its make of pig iron in the fiscal year 1888-9 was only 24,822 tons.

Our situation naturally suggests comparison between ourselves and our neighbors, and when we observe the rapid increase of mineral development in the United States, the great stream of capital flowing in upon the mining districts of the north and south, and the transformation of regions but lately almost uninhabited into scenes of industrial activity, the conclusion seems to be irresistible that if we could succeed in directing enterprise to our own mineral districts results of like kind would surely follow. More than one-half of the capital now invested in the mines and mineral properties of this Province is held by Americans, in spite of the repellent conditions imposed by trade policies upon both sides, and the extent to which it might further be attracted may be conceived by observing the growth of the industry in neighboring States.

The numerous complaints heard by the Commission respecting the mining laws of the province made a careful enquiry into that subject necessary, and in addition to the information given and the suggestions offered by many witnesses the mining laws and regulations of the principal countries of the world have been examined and digests of them prepared, so that our own laws might be considered in the light of a wide experience. It does not appear to your Commissioners, however, that very radical changes are demanded. The provisions of the Act which relate to "mining claims" are found by experience to be unsuited to the occurrence of minerals in this province, where no alluvial deposits of minerals are known to exist, and it does not appear that any properties are being secured under them. It is only in the provisions which relate to "mining locations" that changes in the law are felt to be desirable.

The custom of terming a mining location a mine is itself misleading and mischievous, and unfortunately the terms are synonymous as defined by the Act. Mining men and capitalists have not infrequently met with disappointment in this province by being brought to see a "mine" which has turned out to be only an undeveloped location, and to prevent the recurrence of such mistakes it is desirable that the term should be clearly and accurately defined.

The prospector and the explorer have special claims for consideration at the hands of the Government, for without their services many years may elapse before the

*The table of the Canadian Geological Survey includes in the list of mineral products such articles as brick, charcoal, coke, fertilisers, glass and glassware, iron, iron ore, pottery ware, sewer pipe and tile, steel, sulphuric acid, terra cotta and tile, but as these are not embraced in the United States table their value is struck out of the Canadian total so that a fair comparison may be made. The statistics of 1888 show that the value of the metallic and non-metallic mineral products of Canada in that year was \$12,048,421, and of the United States \$584,550,676, being for the former country \$151,628 and for the latter \$42,266,451 more than the value of their respective products in 1887. See Appendix N.

mineral riches of the country are made known. They should have easy access to sources of information; geological and topographical maps of the territory they propose to examine should be placed in their hands if available; records of every transaction in mining locations should be open to their inspection, and they should be permitted to file and prove claims at the local agencies. The right of staking out claims might also be conceded in unsurveyed districts, under proper regulations. But in all cases it is desirable that proof of discovery of a mineral vein or deposit within the limits of the location applied for should be furnished before a claim is filed.

The extent and number of locations which one person or company may claim or hold cannot easily be regulated in practice, and while in all cases the tenure of mineral lands should be subject to working conditions, it does not seem to your Commissioners that a wise or useful purpose can be served by a provision the effect of which would be to bar the profitable investment of capital. One strong company, if not hindered by a too narrow area, may employ more men and raise more minerals than half a dozen weaker concerns. But prospectors, explorers and miners deserve to be encouraged in the acquisition of locations of small area, and if their conveniences are better suited with the privilege of buying forty or even twenty acres instead of the present minimum of eighty acres, subject to working conditions, the country stands to gain rather than to lose by the sale of the smaller area.

The Commissioners have been impressed with the danger which threatens one of the chief sources of revenue possessed by the Province in prospecting for minerals. They were struck with the appearance of many scenes of desolation where forest fires had swept over wide districts, leaving blackened tree trunks and fire-scorched wastes in the place of hills and valleys once covered with valuable timber. The loss to the Province from this cause has reached many millions of dollars within the last thirty years, and constant danger of further disaster attends the business of prospecting for minerals in forest regions. Moss and leaves often conceal mineral veins, and in addition to the danger arising from carelessness there is reason to believe that unscrupulous persons sometimes set out fires and burn valuable tracts of timber-land merely to facilitate their own work of search for minerals; and still oftener fires are started by the carelessness and even recklessness of sportsmen, tourists, missionaries, surveyors and others. This new danger to our forest wealth is one which may well engage the attention of the Government and the Legislature, and perhaps there is no simpler plan of keeping a check upon prospectors and explorers than to require each one to take out a license at the nearest land office, upon payment of a nominal fee, granting him permission to search for minerals within a district of defined boundaries.

The Act contains no provision for the health and safety of miners, and although no law can ensure workmen against the occurrence of accidents or the effects of foul air, it is none the less necessary that every possible precaution for their health and safety should be taken. Neither is there any provision for the recovery of claims against employers, such as is found in the mining Laws of many other countries, but it may be that the general statutes afford sufficient facilities to mine-workers in the collection of wages without special provision being made to suit their particular circumstances.

The mining industry may be carried on in a country, as it is in many sections of countries, without the smelting of metallic ores being undertaken. Great Britain imports large quantities of iron ores for her furnaces from Spain, Elba, Sweden and elsewhere, and almost the whole of the iron ores raised in the mines of the lake Superior ranges are shipped to furnaces in Chicago, Detroit, Cleveland, Pittsburg and other centres of iron-making in the United States. This practice has the advantage of enabling iron masters to make mixtures of ores suitable for free smelting, as well as to produce the various grades of iron required by the manufacturers. But wherever the conditions are favorable, mining and smelting may be carried on most advantageously as the complements of each other. If sufficient supplies of fuel, flux and a suitable quality of ore are found close together the best location for a furnace is at the mine, especially if there are facilities for shipping the product to market. It is unquestionably in a country's interest not only to smelt its own ores, but to refine and manufacture the metals providing always that the various operations can be carried on economically and without taxing other interests indefinitely for their maintenance.

The history of the iron industry in Great Britain proves conclusively that its growth and prosperity have depended upon a knowledge of methods and processes. Towards the middle of the last century, before mineral fuel began to be used in blast furnaces, the total yearly make of pig iron in that country did not equal the production of one furnace of medium capacity at the present day. The industry was threatened with extinction, from which it was saved by the genius of Abraham Darby, who discovered the means of using bituminous coal as furnace fuel by converting it into coke. He worked out the problem

in the sweat of a sleepless brain, and the narrative of his achievement is one of the most touching in the long story of the triumphs of man over matter. Darby's discovery was the beginning of Britain's career as the chief iron producing and iron manufacturing country of the world, and she owes that position to the service of processes and appliances begotten by the ingenuity of her sons. The cylindrical bellows of Smeaton, the steam-engine of Watt, the puddling process and the puddle rolls of Cort, the hot blast of Neilson, the steam hammer of Nasmyth, the various processes of Huntsman, Heath, Bessemer, Mushet, Siemens and others for the conversion of iron into steel, the utilisation of furnace gases and the improvements in furnace construction, mark every step in the progressive stages of the industry along its wonderful course. And it is mainly upon a knowledge of processes and skill in the use of them, conjoined with capital and prudent enterprise, that we must rely if a prosperous and stable iron industry is ever to be established in this country. We may begin with the best appliances, and with skill and capital we can start upon even terms with the iron men of the United States and Great Britain. But we should begin right—with experienced management, the best working plant, a sufficiency of capital, and not unmindful of the wants of the home market or our trade relations with other countries. The industry is of first class importance, and every proper means should be taken to secure its establishment in Ontario.

The course which a wise policy would naturally suggest is, to begin with whatever branch of the industry promises to give the largest profits and surest results. We have neither anthracite nor bituminous coal, and if one or other of these fuels were used it would require to be hauled long distances at a charge for freight dependent on our ability to furnish return cargoes. Besides, the margin of profit on coke and anthracite iron is never large, and the price is subject to frequent fluctuations as a consequence of the great capacity of British and American furnaces to produce supplies. With charcoal iron the case is different. The supply is limited, the demand is usually constant, superior quality causes it to be indispensable for certain purposes, and where ore, fuel and flux are found in proximity the margin of profit may be regarded as fairly liberal. From data presented in Section v, some of which have been furnished by metallurgists and others by iron masters or the managers of furnaces, it appears that the cost of producing charcoal iron in Ontario would be about \$13.60 per long ton, the figures of ten estimates ranging from \$9.08 for a hot blast furnace of 60 tons daily capacity to \$18.50 for one of five tons capacity. There is no charcoal iron made in Ontario however, and all that is required for the manufacture of malleable castings is imported from the United States at a cost ranging from \$26 to \$38 per long ton according to quality—freight and duty paid. These prices ought to be considered as affording a liberal margin of profit on the cost of production, especially when the statement is made upon expert authority that a furnace of 9,000 tons yearly capacity would earn ten per cent. on a capital of \$200,000 at a profit of \$2.25 per ton of pig iron produced. Furnaces located at favorable points should be able to supply the home market with all the charcoal iron it wants, and, besides, keep out much of the poorer coke iron imported from other countries. The iron masters might even hope to make sales at good prices in the British and American markets, notwithstanding the freight charges on shipments to the one and the high duties which guard entrance to the other.

The most promising mineral works in the Province at present are the mining and smelting of copper and nickel ores in the vicinity of Sudbury. The Canadian Copper company began operations there in the latter part of 1886 and shafts were sunk on three separate locations, one of which had reached a depth of over 500 feet at the close of 1889. The ore body is proven to be very extensive, and large quantities have been raised at each of the mines. One water-jacketed furnace was set up by this company in 1888 and a second in 1889. Each has a capacity of smelting 120 tons of roasted ore per day, producing a matte which carries about 13 per cent. of nickel and 18 per cent. of copper. Computed upon the basis of work in 1889, the annual yield will average 500 tons of refined nickel and 700 tons of refined copper per furnace, and for nicked alone this represents a market value of \$500,000. During 1889 mining operations were commenced in the same district by the Dominion Mineral company of Montreal and Vivian & Co. of Swansea, Wales, the latter being owners of the largest copper smelting and refining works in the world. It is understood that furnaces are being erected by these companies at their respective mines, and that smelting operations will begin at an early day.

The experiments recently carried on in England and Scotland with alloys of nickel and steel, to which reference is made in section v, cause great interest to be attached to Ontario's deposits of nickeliferous ores. If the results already obtained are verified by further tests, and if the claims made for the alloys are fully borne out by practical application in the metallic arts, the importance of the inventions to this Province can hardly be

over-estimated. The ranges already discovered in the region north of Georgian Bay are more extensive than any which have been found elsewhere, and only a small portion of the formation carrying nickel and copper ores has yet been explored. It does not appear unlikely, indeed, that in spite of its unattractive aspect this may prove to be the most valuable portion of territory in the whole of Ontario, and your Commissioners venture to recommend to your Government the importance of carefully investigating its resources and encouraging by every legitimate means their development. The construction of new railway lines may be found necessary for opening new locations; and possibly a practicable scheme can be devised whereby not only the smelting of ores may be carried on upon a large scale, but also that the matte may be refined in the country instead of shipping it to distant places, and that our rich magnetic ores may be utilized in the manufacture of nickel steel.

In order that the mineral resources of the Province may be successfully and economically developed it is desirable that measures should be taken for the practical and scientific training of all who may engage in the industry. Prospectors and explorers are found to be very deficient in the kind of information which would enable them to prosecute their arduous labors to the best advantage, and your Commissioners recommend for that purpose the adoption of a scheme such as has been tried with gratifying results in the colony of New Zealand, and fully explained in Appendix L. But for the education of mining engineers and metallurgists a thorough system of instruction is called for, which can only be provided by establishing a School of Mines or enlarging the course of studies at the School of Practical Science in connection with the Provincial University. It is the opinion of your Commissioners that if the duty of providing instruction of this character devolves upon the Government the obvious plan is to take advantage of the means which are available in the University courses of study, and to make such additions of instructors and appliances as may be necessary for a thorough equipment. And for economic and educational purposes of the first importance your Commissioners further recommend the establishing of a bureau of mines for the purpose of making a complete geological survey of the Province, and a museum of geology and mineralogy to represent its rock formations, minerals and metallurgical products, together with an efficient plan for the collection of yearly statistics of the mining and metallurgical industries of the Province, as indicated in Section vi. of their report herewith respectfully submitted for Your Honor's consideration.

Signed John Charlton, Chairman; Robert Bell, William Coe, Wm. Hamilton Merritt, Archibald Blue, Secretary.

Toronto, April, 1890.

Note on the occurrence of Native Copper in the Animikie rocks of Thunder Bay.

By Andrew C. Lawson, Ottawa, Ont.

Among the rock formations of lake Superior, the Keweenaw or Nipigon series has long been recognized as strongly characterized and differentiated from older and newer rocks, by the occurrence of deposits of native copper. So distinctive have these features appeared that a common synonym for the series is "The copper-bearing rocks." No occurrence of native copper in the Animikie rocks has, so far as the author is aware, been recorded. Any facts therefore, which indicate that native copper is not peculiar to the Keweenaw series, but occurs under somewhat analogous conditions in association with the Animikie rocks, which underlie it, will be received with interest both by geologists and miners familiar with Lake Superior. Such facts have come under the notice of the writer during the past season, and it is here proposed to give a brief account of them since it will be some considerable time before a systematic report of the geology of the region can be published.

Field occurrence:—Along the west side of S. W. $\frac{1}{4}$ Sec. 8. Con. VI. in the township of Blake, District of Thunder Bay, runs a north and south trending ridge which presents an abrupt escarpment about two hundred feet high facing the east. To the west of the brink of the escarpment the surface slopes gradually to the old Pigeon River road. The section exposed in the face of the escarpment is very characteristic of all the numerous similar escarpments of this portion of the country and consists of about 150 ft. of nearly flat lying black shales and thin gray siliceous beds of the Animikie series, capped by about 50 ft. of vertically columnar diabase trap. Near the south end of the quarter section, there is an indentation or bay in the face of the escarpment affording a steep slope whereby it may be ascended from the valley to the east. At the foot of this slope some Indian prospectors found some pieces of amygdaloidal trap carrying native copper, which were brought to my notice at Port Arthur by Mr. C. Johnson, who had become interested in the find. In company with Mr. Johnson and his Indian guide I visited the ground last October, and

found extending up the surface of this slope a dyke-like ridge of cupiferous amygdaloid. The surface had not been stripped, but was covered with soil, forest loam, brush, tree roots and moss. There were, however, four or five outcrops along the ridge from the bottom of the slope up to an elevation of 100 ft. These lay in a line which, by the compass, had a bearing of N. E. and S. W., which is the strike of the deposit provided it be a vertical attitude; but this question cannot be determined till farther stripping and exploring has been done. If the deposit has a dip or lode, the true strike, which is of importance as a guide to further exploration, would have some other direction than N. E. and S. W. The outcrops show very clearly a width of at least 15 to 20 ft., though nowhere is the contact with the country rock exposed. The trap has a much more pronounced amygdaloidal structure at the base of the slope than higher up, but does not carry so much visible copper. The whole appearance is that of a dyke filling a fissure in the Animikie strata. Whether the amygdaloidal trap cuts the diabase trap cap which rests on the shales, cannot at present be determined. It probably does not.

There are, however, some circumstances which, in view of the meagreness of the exposures, render other explanations possible, and the conclusion that the formation is a dyke can only be held tentatively. These are (1) that at a level of 100 ft. up the slope there is a small outcrop of a fine-grained, brownish red sandstone such as is common in the Keweenaw series, but which has nowhere been observed by the writer in the Animikie; (2) dykes do not usually present a highly vesicular or amygdaloidal structure which is rather the characteristic of surface flows; (3) the supposed dykes are much more vesicular and the vesicles are larger at the foot of the sloping line of outcrop than at the top, which is contrary to what we would expect with reference to the formation of vesicles in any molten mass of rock, the mass being usually more vesicular toward the top where the pressure is less. The other possible explanations, none of which are supported by any direct field evidence, are (1) that the supposed dyke may be a small piece which has been let down within the Animikie by faulting from the Nipigon, which may be supposed to have once covered the Animikie here as it does elsewhere; or (2) it may be the infilling of a fissure in the Animikie formation from above by a surface flow of vesicular lava which brought down with it portions of the Nipigon sandstone; or (3), least likely of all, it may be a small outlying patch of the Nipigon resting on the surface of a pre-existing slope of the Animikie.

A little exploration and mining would soon set at rest these questions as to the precise nature of the formation. We have this fact at least, that it is a rock of the same facies as the amygdaloids of the Keweenaw or Nipigon similarly charged with copper, well within the Animikie slates and apparently cutting them. In this respect the formation differs from the amygdaloids of the Keweenaw, which are interbedded and contemporaneous with the other rocks of that age, while the formation here discussed is apparently of later age than the Animikie, and may very probably be of Keweenaw age, though associated with Animikie rocks.

Character of the Rock.—The rock in which the copper occurs is a fine textured purplish-brown trap strongly amygdaloidal in some portions and only feebly so in others. The least amygdaloidal portions when examined in thin section prove to be typical diabase. Slender idiomorphic plagioclase crystals lie embedded in allotriomorphic masses of purplish to yellowish gray augite and in yellowish green masses of chlorite which is doubtless the result of the alteration of the augite. Yellowish brown iron oxide partly opaque and partly translucent occurs in profusely scattered grains.

The more amygdaloidal portions show in thin sections a finer texture but an equally strongly pronounced ophitic structure. Augite is not so abundant and plagioclase is the dominant mineral. A portion of the base appears to be glass, being colourless and isotropic; and the augite is probably represented in part by the glass and in part by certain decomposition products interstitial between the feldspars. Magnetite and brown iron oxide are generally distributed. The crystals of plagioclase are arranged tangentially to the periphery of the amygdaloidal cavities. The latter are filled with calcite or dolomite and a brightly polarizing fibrous or lamellar mineral doubtless a zeolite. In the thin section examined no copper was detected, but microscopically it may be seen scattered through the rock in small grains which do not appear to fill up the round vesicles, but to be more irregular in shape.

The brown red sandstone above referred to is very fine textured and could not be identified as a sandstone with certainty in the field. In this section it is seen to consist of an aggregate of rounded, pear-shaped and angular grains of feldspar, pyroxene, chlorite and quartz, all the grains having a coating of iron oxide. A good deal of the secondary matrix appears to be feldspar, probably albite and orthoclase, and it is full of slender colourless needle-like microlites. Twinning lamellæ of the secondary feldspar are in some cases distinct, but for

the most part are not apparent. Some of the rounded clastic grains of feldspar show feeble traces of secondary growth.

Proportion of Copper.—A few specimens of the rock were collected with the view of ascertaining its average value as a copper ore. Four of these have been submitted to Mr. F. L. Sperry, chemist to the Canadian Copper Co., at Sudbury, who has very kindly analyzed them. These specimens taken from different parts of the outcrop at an elevation of 64 feet above the foot of the slope, and one from the lowest outcrop gave the following percentages of copper:—

Sample No. 1, 64 feet level.....	1.32% Copper.
" No. 2, lowest outcrop.....	0.27% "
" No. 3, 64 feet level.....	2.88% "
" No. 4, ".....	3.57% "

Besides this occurrence the writer was also shown other specimens of amygdaloidal trap carrying native copper, which were said to come from the township of Crooks; but although the locality was carefully examined the deposit could not be found as the services of the guide who knew its whereabouts could not be secured. Later in the season Mr. Hille, mining engineer of Port Arthur, secured the necessary guide and proceeded to the place where these specimens were taken, and he has since informed the writer that he succeeded in locating a dyke-like formation of amygdaloidal trap carrying copper in sec. 4, con. II of Crooks. But enough has been advanced to show that the Animikie rocks of Thunder Bay are worth careful prospecting for copper.

Peculiar Working of a Blast-Furnace.*

By N. G. Wittman, Birdsboro, Pa.

The working of blast-furnaces is always of interest to many members of the Institute, for which reason I present an account of the working of the furnaces of the E. and G. Brooke Iron Company, of which I have had charge for the past four years. Although there are no phenomenal runs to record, there have been long periods of satisfactory work, and also periods—altogether too long—when one of our furnaces has behaved in a way which may be described as "nagging." All the conditions were apparently normal, but only a very light burden could be carried, which of course resulted in a high fuel consumption to the ton of iron, as well as increased cost of labor.

The two active furnaces of this company have the following dimensions and equipment:

	No. 2. Feet.	No. 3. Feet.
Height.....	55	60
Diameter at Bosh.....	15	16
" hearth.....	8	7½
" stock-line.....	10	9½
Height of bosh.....	23	23
" tuyeres.....	5½	5
Diameter of bell.....	7	6
Front.....	closed	open

Both furnaces are blown with I. P. Morris condensing engines, similar in all respects save one, the engine of No. 2 having a steam cylinder of 45 inches diameter, while that of No. 3 is 50 inches. In both the diameter of the air cylinder is 90 inches, and the stroke 84 inches.

In both cases the stock is raised by an air-hoist.

In No. 2 the blast is heated by three Durham stoves of 28 pipes each, the pipes being 14 feet high and 8 inches inside diameter. No. 3 has two Kent ovens, 40 pipes in each, 14 feet high by 7 inches inside diameter.

The ore mixture, which is practically the same for both furnaces, consists of 75 per cent. magnetites and 25 per cent. Lake Superior or foreign hematites.

About 40 per cent. of the magnetic ore is similar in character to that of Cornwall, except that it carries a variable amount of free calcite, ranging from nothing to 8 per cent. The sulphur in it is also very inconstant, the extreme range being from 1 to 4½ per cent., probably an average of about 2½ per cent. There appears to be no definite relation between the percentage of free calcite and sulphur, the latter being in the form of pyrites, agglomerated with the ore, while the former occurs in loose pieces, varying in size from grains of sand to masses weighing several pounds.

The general gangue of the ore is hornblende, with which the calcite is sometimes associated intimately, as it seldom is with the ore.

This ore is the only one used which is inherently troublesome to work.

The points of difficulty are, that the calcite being variable, it is impossible to flux it with any degree of certainty as to the composition of the cinder, and that a large portion of the sulphur is oxidized to sulphuric acid, and combines with the lime, forming calcic sulphate or gypsum, so that it is only practicable to reduce the sulphur about one-half by roasting.

The ore disintegrates very rapidly, and there are several soft veins in the mine, so that a considerable portion of it is fine, like sand.

It is a well known fact that an ore carrying sulphur in material quantity, cools the hearth of the furnace, probably by dissociation of calcite sulphate, and "buckshot" results, while the hearth is "built up."

The fuel used is anthracite, with as much coke (usually from 20 to 30 per cent. of the fuel charge) as the price of coke will permit.

Dolomite of very uniform composition is used as a flux, for the reason that no calcite of good quality is available.

About 1.8 tons of ore are required to the ton of iron, and 0.8 ton of stone is added to form a cinder of approximately 35 SiO₂, 12 Al₂O₃, 33 CaO and CaS, and 20 MgO.

As an instance of satisfactory work may be cited the record of furnace No. 3 for nine consecutive months, during which time 18,422 tons of iron were made, being an average of 472.36 tons weekly, on a fuel consumption of 1.19 tons to the ton of iron. The best week's output was 531 tons, made with 1.05 tons of fuel per ton of iron.

This furnace was filled and blown in as follows: Three stands of oak wood were put above the tuyeres, and the hearth was packed full of light dry pine, saturated with oil. On top of the wood was put, as a blank, 26 tons of coke, with about 2 tons of good gray furnace-cinder to flux the ash of the coke and wood. Ore-charges were then commenced with 2,000 pounds fuel (½ anthracite and ½ coke), 1,300 pounds ore, and stone calculated to form a slag of 39 per cent. SiO₂. The burden was increased 200 pounds every six charges, until the stack was full, after which the fuel-charge was 66½ per cent. anthracite and 33½ per cent. coke. The furnace was lighted at the tapping-hole and tuyeres. The wood burned well, and as soon as bright coke appeared at the tuyeres the blast was put on, and everything went off smoothly. The volume of blast was increased so that in ten days the maximum was attained. This furnace continued in blast over three years; had all sorts of mishaps, due to break-downs in machinery, which necessitated long stoppages without preparation; yet always worked without trouble, and, for the greater part of the time, with very satisfactory economy in fuel. It will be remembered that the lines of this furnace are by no means modern.

Furnace No. 2 was blown in, as nearly as possible, in exactly the same way, and went off equally well; but the work for the first nine months of the blast—which is the present one—was vastly different.

The general features of the process were normal; the stock settled evenly all around; tuyeres bright; gas good and plentiful; cinder hot and of proper basicity; but there was no indication that a heavier burden could be carried. The charge at the time of blowing-in was: fuel, 2,000 pounds; ore, 2,600 pounds; stone, 1,240 pounds. After a few days an attempt was made to add more burden, although the iron was only an ordinary gray-forged; but after the additional ore—60 pounds—came to work, the iron was closer in grain, and evidence was soon given that the furnace was overburdened. The only abnormal feature was low pressure of blast, the gauge registering only 4½ pounds per square inch for two or three weeks after blowing-in, and gradually rising to 5½ pounds, where it remained for about three months. The usual pressure with ¾ anthracite and ¼ coke (the fuel-mixture then in use) is 7 to 8 pounds, and the low pressure indicated the possibility of working up the center, or "ring-scaffolding." To ascertain whether this was the case, and at the same time endeavor to correct it, a fuel-blank of 20 tons was charged, with scrap enough to keep the iron from becoming too gray.

When this had been in the furnace about ten hours, the speed of the engine was reduced three revolutions, so that there might be a tendency of the blast to work up the walls and loosen any matter which adhered to them, and get it into the hearth about the time the extra fuel reached there. The presence of the blank in the melting-zone was manifested by the cinder in about twenty hours after it was charged at the tunnel-head, and after 60 charges or rounds had been put in on top of it (the volume of which would occupy the space between the stock-line and bosh), showing that the melting-zone was in the region of the bosh, and that no considerable accumulations were on the walls. The working of the furnace was not at all improved by the blank, or changed in any way that was perceptible. During the time from blowing-in, November, 1888, to March, 1889, the best week's work was 445 tons of iron of 1.3 tons of fuel per ton of iron, and the average production for five consecutive weeks was 431 tons, requiring 1.3 tons of fuel per ton of iron. The pressure still continued low. After some time it was discovered that the collars connecting the pipes in the mains in the hot-blast stoves had "raised" in all the ovens, and that several of them were split, so that it became necessary to give them a thorough overhauling, which occupied the greater portion of three weeks. While these repairs were being made two ovens were used, and the volume of blast had to be diminished in order to keep up its temperature. It may be mentioned here, as a tale of misfortune, that when one oven was off, and about twelve hours before it could be ready for service, a violent rain storm occurred; a water-

* Washington meeting of American Institute of Mining Engineers.

conductor, which passed over one of the ovens, became disconnected at a joint, and the water poured on the roof of the oven and found its way between two plates, which had warped somewhat, in a sufficient quantity to crack a piece out of one of the pipes. The piece was large enough to cause the hot-blast valve to drop, and the furnace being full of cinder at the time, the belly-pipes, all filled. This necessitated a stop of about four hours to clean them out, after which we were obliged to run twelve hours with one oven of twenty-eight pipes and a blast-temperature of 600°. Finally, the ovens were all in good shape again, and some improvement was noted in the working over that immediately preceding the time when repairs were commenced, but not nearly so much as I had hoped for. The pressure had gradually risen to 7 pounds, but the fuel-consumption per ton of iron remained high, and it was not long until the production fell off to less than before repairs were made, and the fuel rose to still higher figures. The pressure remained at 7 to 7½ pounds per square inch.

During the months of July and August the results were most discouraging. The average production for five weeks during that time was 361.8 tons, each requiring 1.508 tons, of fuel. The worst week's work was: iron, 356 tons; fuel-rate, 1.6 tons.

The only abnormal feature apparent was that, during casting, the cinder would run out very hot and fluid, separating perfectly from the iron, until about one-third of it had run; then a mass of "buckshot" would follow, often choking under the skimmer, and causing iron to run out into the cinder-runners. This was followed by about an equal amount of hot, fluid cinder entirely free from buckshot. At some casts no buckshot was made, but when it did appear it was almost invariably in the way stated. This was a very unusual thing. In our previous experience with buckshot it had made its appearance with cinder visibly cold, the hearth would soon build up, and iron would be thrown out of the cinder-notch during flushing. In this instance, however, the cinder which preceded and followed the buckshot was hot and fluid, the hearth did not build up, and no iron was thrown out of the cinder-notch. The appearance of the cinder was unusually good. It is our practice to ladle out a sample of each flush of cinder while it is running, and pour it into a scorifying-mould, so that buttons from the various flushes can be compared. At this time there was scarcely any difference noticeable between flushes. One sample would represent the entire day's work; yet at some casts two or three tons of buckshot would run out and at others none. The top of the furnace was as cool as could be expected with such a light burden—about 600°, when the fillers were at work, which would increase to 700° or 750° when they stopped for an hour.

No gas-analyses were made, but the gas was clean and good. No firing was at any time necessary under the boilers, and the bleeder was seldom opened. The slides on the gas-valves of the hot-blast chambers were seldom moved. Everything seemed right, yet the results showed that something was seriously wrong.

The coke strike occurred about the time we were most troubled with buckshot, and it was necessary for several days to increase the proportion of anthracite to 87½ per cent. This resulted in less iron and more buckshot. I mention the fact, as it will have a bearing later on. During the first week in September a slight improvement was noticed; no change had been made in any particular, and there was no reason to think that it was more than a temporary relief, after which a relapse might at any time be expected. The relapse, however, did not come. There was no more buckshot, and the iron indicated that more burden could be carried. The iron, at the time when the improved working commenced, was peculiar. It was only a good gray-forged iron, but there was an appearance about it difficult to describe, though familiar to those who grade iron by its fracture, which indicated that it was very much grayer than the grain would lead one to suppose. Burden was added in 40-pound lots, with stone in suitable quantity, and when it came to work, evidence was still given that a little more could be carried. This was done in 40-pound lots at first, and 80-pound after there seemed less danger of overdoing the matter, until 800 pounds more ore was carried by 2000 pounds of fuel than had been possible during the summer. The period of transition from light burden to heavy occupied about three weeks, during which time the iron only varied in grain from very gray-forged to close gray-forged. The volume of blast, measured by piston-displacement, was steadily maintained, and the production increased for the five weeks ending with October to an average of 464.6 tons of iron, made with 1.206 tons of fuel per ton of iron. The best week was 507 tons of iron, made on 1.18 tons fuel-rate. On October 1st, when the price of coke advanced, the proportion in the mixture was reduced to 20 per cent. with which the best work was done. It was further reduced to 12½ per cent., which had caused much trouble during the summer; but at this time it had no such effect, and 488 tons of iron were made in a week with 1.2 tons of fuel. After running two weeks, however, it was deemed advisable to return to 20 per cent. of coke,

the production having dropped to 453 tons; and now the production averages 69 tons daily, and the fuel is fairly constant at 1.2 tons per ton of iron. During the summer, when the results were most distressing, the process appeared singularly uniform, and no evidence of scaffolding could be detected. Now there is no uniformity whatever; the stock slips sometimes from 4 to 6 feet at flushing; the cinder varies from bluishwhite with stony fracture to black with vitreous fracture, yet is always hot and fluid. The iron varies from foundry to mottled between casts; and the cinder is but a poor guide, as the gray cinder sometimes makes close iron, and the dark glassy cinder does not always make hard iron. There is much more evidence of scaffolding now than there was during the summer, but the cost-sheet has a much healthier look.

It is likely that, apart from atmospheric conditions, the ordinary causes which affect irregularities of working are: arching of the stock, thereby forming a temporary scaffold; dropping of unprepared stock, which has been adhering to the walls as a fixed scaffold; and filtration of fine ore through the coarse stock, reaching the hearth in the state of ore and desilicizing the iron, thereby lowering its grade.

I was unable to detect any form of scaffolding, and as the proportion of fine ore in the mixture has not changed, it is not likely that it influenced the process. When a furnace does not work economically, it is customary to say there is a scaffold; but it has seemed to me that this term is often applied to express an abnormal condition, the cause of which is obscure. Scaffolds, in order to exercise a material influence on the process, must occupy considerable space; and, although our means of estimating the working capacity of a furnace between the stock-line and the melting-zone are very crude, it is at least possible to ascertain whether there is a very considerable contraction in the cubic capacity contained between the stock-line and bosh or not.

In furnace No. 2, large fuel-blanks have been discharged, from time to time, when it seemed desirable for any reason to do so; and after 58 to 64 ore-charges were on top of the fuel, its presence became apparent in the melting-zone. There has been no variation observed in this respect at any time during the blast. At one time, during a former blast, when the furnace was working badly, a fuel-blank would work after 27 to 30 charges were on top of it. It was not difficult to determine then that the melting-zone was high, and that a scaffold existed.

It has been my practice to maintain a uniform volume of blast, measured by piston-displacement, under all circumstances, and to distribute the current according to the manner in which the stock settles on top. If the settling is even, tuyeres of equal area are used all around. If there is a marked tendency to settle faster on one side than another for a few days, nozzles are put in the tuyeres under the low side, and the blast, flowing in the direction of least resistance, naturally goes in greater volume through the large tuyeres, and cause the furnace to work faster on the side which was high. In this way incipient scaffolds are moved, and dangerous ones are not likely to form suddenly.

The practice of reducing the speed of the engine whenever the cinder becomes sharp I have always regarded as likely to form scaffolds on account of alternately raising and lowering the melting-zone, and, as I could never see how heat could be generated by diminishing the rate of combustion, I have avoided it.

The working of the furnace in question has been a mystery to me, and this account of it has been written in the hope that it may meet the notice of some among the members of the Institute who have had similar experience, and, more fortunate than I, have ascertained the cause. It is not usual to proclaim one's poor work in all its details and confess ignorance of its cause; but if one cannot get light without opening the windows, they had better be opened, though other people may thus be enabled to look in.

The Royal Mining School of Freiberg.

Of the numerous mining schools of Europe, probably the Royal Saxon "Bergakademie" of Freiberg has trained the largest number of successful miners and metallurgists, and the title of M.E. of that school is a guarantee of excellence, and serves as a recommendation of the greatest value. The reason of this is obvious when we know that the system of instruction carried on here is a thoroughly practical one, so that the students are brought into actual contact with the operations on a large scale. The object of this time-honored institution is to give a complete scientific education, both of a theoretical and practical character, to young men intended for metallurgists or mining engineers. Admission to the school for Saxons and Germans is made dependent on having passed the Maturitäts examination of a gymnasium or first class Real-school, but foreigners are received without examination, provided they bring certificates of competence from some recognized scientific or educational institution, and this liberality on the part of the Saxon Government has been

largely availed of by many distinguished English and American metallurgists and mining engineers. Regular courses of study are laid down, extending over four years and differing according as the pupil desires to follow the mining or the metallurgical branch of the profession. Higher mathematics, descriptive geometry, spherical trigonometry, physics, chemistry, mineralogy, geology and mechanical drawing form the groundwork of the studies, to which are added, in the second and succeeding years, the special subjects of mining and metallurgy, and all their allied branches of science, taught by lectures, laboratory practice, by working and surveying in the mines, and by practical metallurgical instruction in the smelting works of the Saxon state.

The collections of mineralogical and geological specimens are most complete, and with the libraries and museums of mining machinery are open to all the students of the school. Many of the professors have been men of European fame—Werner, Plattner, and now Richter and Weisbach, are names known to and honored by all students of science. The lectures of Richter on the blow-pipe are unique, and those of Prof. Weisbach on mineralogy are most valuable. But the most important respect in which Freiberg excels is the practical experience which the students can gain in the operations of smelting conducted on a large scale in the government smelting works (the Müldnerhütte and that at Halsbrücke) as well as in those of mining by visiting the neighboring mines belonging to the Saxon government. As these mines now yield ore of only the poorest quality the operations have to be conducted with great care, and hence offer to the student of mining training of an exceptional character, while the number of metals present in the ore (gold, silver, copper, lead, bismuth, arsenic and antimony) and worked up at the smelting works afford a no less valuable one to the student in many branches of metallurgy. The cost of living in Freiberg, including the fees payable to the academy, need not exceed £100 per annum. The average number of students in training for the last ten years: Saxons and Germans, 64; foreigners, 58. Freiberg does not, however, afford practical instruction in iron mining or smelting; the mining school specially adapted for the study of the metallurgy of iron is that of Leoben in Styria under its veteran head, Prof. von Tunner.

The Invisible Costs in Quarrying.

Those unacquainted with the stone business are apt, like novitiates in other lines, to underestimate the costs. They see a body of stone accessible, and they know what it will cost to extract a given number of square yards of it. They also may know how much a given number of men with a given number of gangs of saws may saw up in a given time. If they base their costs on this, they will see a profit where old quarrymen claim a loss. But usually they seldom reckon on the "invisible costs" which, like Banquo's ghost, will rise to confront them at most inopportune moments.

In the first place novitiates seldom reckon on the loss their quarry beds sustain. Every foot of stone taken from a quarry represents an irretrievable loss to it. It can never be replaced, and as time goes on acres and acres of territory are denuded of their wealth, until finally they are exhausted. The costs of quarrying it do not represent this loss, which must be added, or the time will come when the operations must cease, or the profits of the business must provide means for the purchase and opening of new territory.

Again, the young quarryman will start out with a full complement of derricks, channeling machines, drills and power plant, all new. But from this instant they begin to wear, and the time rapidly approaches when the profits of the business must guarantee a new outfit; or else new devices are invented that lead to the same result, or the business must join the long list of the unprofitable.

Again, in placing the stone on the market, are a number of unforeseen adverse conditions. A piece of stone worth hundreds of dollars will get broken, to be reproduced without pay. A favorite and prompt-paying customer goes bankrupt (and this will occasionally happen to the most conservative manager). Then are added costs of delays, breakage and derelictions of railroad companies, and the costs of their own agents, none of which figure in the cost of extracting numberless yards of stone in quarry.

Every penny of waste, every penny of cost, every cent for repair down to the last drop of oil, will soon or late rise up for liquidation. Yet they are invisible in the estimate of cost for a given number of yards of quarry production. And it will take nearly 20 per cent. added, and it may take 33, to make the items of cost equal the items of receipts where these various losses are considered.

When a young quarryman begins he rarely considers these invisible but constant losses. He sees the older men charging more than he figures he can take out a given number of cubic yards for, and he concludes there is a bonanza in it, and all he has to do is to get on the market, even if at the loss of a few cents, which he con-

ceives he can make out of these great "profits." He finds out his mistake—he has learned the invisible costs, but meantime he has forced the older men to reduce theirs in order to retain the market they have already earned. He has destroyed his own profits, and reduced those of his competitors, and the result is the entire trade is lowered in tone, capacity and profit.

On the other hand is the old quarryman who either has, or conceives he has, a quarry so easy to work that competition with him is fruitless, and who may from this fact further improve his sales by reducing his prices. Failing to pocket the profit that his good fortune assures him, he strikes at the income of his neighbour. It is notorious that the consumer is paying the contractor prices out of all proportion with what the quarryman is getting, and which a well-understood basis or organization could easily remedy. If a portion of the profit in the stone business now going to the contractor and other middlemen were divided with themselves and consumer, advantage to both would result, and the use of stone greatly extended, while the quarryman, with much more business, at the same time would reap a higher price.—*Stone.*

The Superphosphate Works at Smith's Falls.

The following description of the Standard Fertilizer and Chemical Co.'s works at Smith's Falls, Ont., is given by the Commissioners in their Report just issued:—

Various grades of superphosphate are manufactured for fertilizing purposes, and acid phosphate is also made at the works which is used for baking powder, etc. The sulphuric acid used in the process is manufactured from brimstone imported from Sicily, and costing at Smith's Falls one cent per pound. The apatite is ground very fine by burrstones, after which it is conveyed into a vat by means of a fan. The coarse dust falls back to the stones and is reground. The apatite requires to be pulverized to such a degree of fineness that if bolted it would go through a 120 mesh, or at least an 80 mesh. The charge is weighed out, moistened with sulphuric acid and run into the mixer, and thence into an air-tight bin that has a wooden funnel above to carry off the hydrofluoric acid which generates. The acid and phosphate of lime work in this bin and solidify in twenty-four hours. It is then broken up by a sort of disintegrator, and after being mixed with various proportions of hydrochloric acid, ammonium, potash, ammonium sulphate and nitrate of soda, it is ready for shipment. The following grade of fertilizers are manufactured:—

No. I.....	\$ 32.00 per ton.
No. II Standard.....	35.00 "
No. III Special.....	40.00 "
No. IV. Fruit Tree.....	42.00 "
Plain Superphosphate.....	26.00 "

Acid phosphate is also manufactured by this company. Only the purest ground phosphate is used for its production, which is carefully sorted by hand. After the acid has dissolved the phosphate the charge is leached off, and the product is the liquid phosphate. This is then evaporated down to a syrupy condition, is mixed with starch and dried, after which it is ground. It is used as a substitute for cream of tartar, and chiefly as a baking powder. The phosphate used at the works comes from Burgess and from Buckingham. The high grade (83 or 84 per cent.) used for acid phosphate costs \$17.50 at the factory, and the low grade (65 per cent.) costs about \$9.60. Farmers use about 300 pounds of the fertilizer to the acre, and that quantity is claimed to have the same effect as 25 wagon loads of well-rotted barn-yard manure. Market gardeners use 800 to 1,000 lbs. per acre. The ammonium sulphate costs \$60 per ton, and \$11 worth is put in a ton of the fertilizer. This and the potash are imported from Germany. Of the output of the works about seven-eighths of the grades is special and standard, and the price obtained averages \$35 per ton. The lead chambers in the works cost about \$10,000, and the pure sulphur is said to be much less severe upon these than when iron pyrites is used. The sulphur also occupies less room, and a boy can look after the furnace. The cost of producing sulphuric acid is about 70 cents per 100 pounds.

New Use for Mica.

The principal use to which mica has been put heretofore was for stove doors and for decorative purposes, such as bronzing, wall-papering, etc. When properly prepared, it can be used for a variety of purposes, and the discovery of this fact has led inventive genius to supply a process whereby it can be so utilized, and machinery has been brought out for the purpose of handling the mineral.

The new field thus opened to this mineral is as a lubricant for railroad purposes, and its value for this purpose lies in the fact that it is absolutely anti-friction, and it is claimed that with its use hot boxes or journals are simply impossible. A company has been incorporated in Denver, Colorado, under the name of the Railroad Mica Lubricating Company, with a capital of \$200,000, and they have purchased the machinery, together with the process of manufacture, all of which are covered by patents. A visitor to the factory thus describes operations:—

The mica comes to the factory in carloads, just as it is taken from the mine. It is fed by boys into two machines, which cut it into fragments about half an inch in size. By a system of pneumatic tubes the mica, so cut, is delivered to the atomizing machines, which grind it into powder.

These machines one must see to fully realize their peculiar action and construction. Each machine consists of two steel shafts three feet long, with a series of gun metal spirally arranged beaters, which revolve in a closed case forming a figure. When in operation these machines make from 5,000 to 7,000 revolutions a minute. The beaters on the revolving shafts are so arranged that the fingers on one pass between the fingers on the other shaft, so that when the material is passed through the pneumatic tubes from the feeding machine to the atomizers at a velocity of 15,000 feet a minute, the work of atomizing is instantaneous.

The mica, now reduced to atoms, continues its course at the same velocity through another set of pneumatic tubes to the sifting bins. Here the current is so retarded by the peculiar mechanism that it causes the material to settle in the various compartments, of which there are six, at the same time grading the material according to its fineness. The powdered mica is now settled in the hoppers or bins, immediately over the mixing pans. Here the several grades are drawn into the pans, which are provided with mechanical mixers, and the lubricant is made up by the use of the proper percentage of oils, mica and such other ingredients as the company uses in the manufacture of the product.

Directly over the hoppers are located the oil tanks, which supply the mixers by a pipe running down on the outside of the hopper, on the end of which is a faucet.

At the south end of the bins there is located a large cylindrical machine four feet in diameter and ten feet high, that is called a dust arrester. Any of the material that is so light and fine that it will not settle is driven into this machine by air currents, which thoroughly separate the mica dust from the air, where it settles in the bottom of the machine and is drawn off as needed.

It is stated that the capacity of all machinery heretofore made for pulverizing mica has been from 300 to 400 pounds a day, and then the material has not been sufficiently fine for lubricating purposes. It is claimed for this new concern that it can pulverize about five tons a day, or in ten hours running.

Estimating the Cost of Foundry Work.—In a paper read before the American Society of Mechanical Engineers, Mr. G. L. Fowler observes that the expense of moulding is the basis upon which all estimates and calculations should be founded, coupled with a careful consideration of the weights and cost of the iron and fuel. The author classifies the expenditure under various heads, and then determines in what relationship they stand to one another. The various ratios having been determined, the timekeeper should every day take the time of each moulder and the work on which he has been engaged. This gives the necessary basis for the calculation of the cost. The various ratios already determined are added together and multiplied by the wages paid; to the product is then added the wages, and the cost of the iron in the casting. The result is the cost of the casting. The author gives the following example; 40 cents is paid for moulding a grate-bar weighing 100 lbs; the sum of the several ratios is 1.2, and the cost of iron and fuel was 1 cent per lb. of casting, then:—

Sum of all ratios multiplied by the moulder's wages.....	\$0 48
Moulder's wages.....	0 40
Cost of iron.....	1 00
Total cost of the grate-bar.....	\$1 88

The author states that this method of calculation has been employed for the last seventeen years by Mr. A. Messerschmidt at Essen, Germany. The author, too, has found in his own experience of the practical application of the method, that it is of very considerable commercial value.

Safety cages—A good many years ago what are known as safety cages were not uncommon in England, and on the Continent they were compulsory by law. Their action is simple; so long as the load is on the rope the catches on

the cage are out of action; but when a rope breaks, and the load goes off, the catches come into action, grip the conductors, and hold the cage. There were two advantages which these safety cages formerly had—the speed of winding was slow, and the conductors were of wood, affording facilities for gripping. Now the speed of winding is very rapid, and the conductors, a good many of them, are of wire. There is some danger of such cages acting when they should not, and not gripping when they should. It is a fact that safety cages are not now as numerous in proportion to the collieries as formerly, and on the Continent are not now compulsory. Safety cages are intended to act when ropes break; but those who do not care for them say that ropes of proper material, well made, worked on proper machinery, and not overloaded, ought not to break, and will not break. It must be remembered also that even with a safety cage we have nothing to prevent the lower part of a broken rope falling down the pit and doing injury.

Coal Mining by Machinery.—In Illinois in 1888 there were 272 machines at work for mining coal. With them, 3,088 men produced 2,243,210 tons of lump coal, or 20 per cent. of the total production. Of these machines, 245 are of the Harrison type, 17 are the Legg or Lechner machines, and 10 are the Yock machines. Owing to the thorough division of labour which the use of machinery induces, it is more likely that both timbering and blasting are efficiently performed.

Shaft Sinking by the Kind-Chaudron Method.

M. J. Chaudron (excerpt from *L'Industrie*), gives a list of shafts sunk by the Kind-Chaudron method since 1878. There are five in Belgium, three in France, one in England, and seven in Germany, or sixteen altogether. Full details and illustrations are given of three of the more important. A new departure was made at the collieries of Gneisenau, Westphalia, by lining the shaft only where it passes through water-bearing strata. This was done by closing the lining with a diaphragm, both at the top and bottom, so as to obtain an air-tight vessel into which water could be admitted as desired to control its buoyancy. In order to be certain of stopping out all the water, the lining was carried upwards for a distance of about 82 feet above the water-bearing strata, which were 142 feet thick.

At the salt mines of Thierderhall, Brunswick, great difficulty was experienced owing to running ground. No less than eight separate linings had to be used, each one just overlapping the next, so that the shaft is reduced in diameter from 13 feet 9 inches to 10 feet 3 inches, at a depth of 354 feet.

The Kind-Chaudron method of boring shafts has been successfully carried out, for the eighth time in Germany, at Leopoldshall. Several attempts to sink a new shaft having failed on account of the influx of water, the Kind-Chaudron method was adopted, and the shaft completed in 17 months. The small shaft was sunk with a borer 8¼ feet in diameter and about 16 tons in weight. For the subsequent boring down to the impermeable strata, a tool, 14 feet in diameter and 20 tons in weight, was employed.

Lignite Briquettes.—In a paper read at the German Mining Congress at Halle, the uselessness of attempting to dry the lignite used in the manufacture of briquettes is pointed out by Vollert, experience having shown that the presence of from 15 to 20 per cent. of moisture in the briquette greatly increases its resistance to atmospheric action and to disintegration during transport. Great care has to be taken to prevent the collection of dust during the manufacture of the briquettes, owing to its liability to explode. The numerous arrangements which have been adopted to prevent danger from such explosions are referred to by Schrockner, who shows that, whilst in 1875 there were in North Germany only twenty-nine briquette presses, consuming annually two hundred and fifty thousand tons of lignite, there are, at the present time, 186 such presses at work, each giving employment to 10 men, with an annual consumption of 2,250,000 tons of lignite, and a production of 1,250,000 tons of briquettes. Unfortunately, this manufacture of lignite into briquettes is accompanied by considerable danger, owing to the evolution of hydrogen and other gas, and to the explosive character of the dust produced in the manufacture. This dangerous deposition of dust takes place partly during the preliminary drying of the fuel, but more especially during the transport of the dried material to the press. In conclusion, the various mechanical arrangements which have been introduced to prevent such dust deposits are referred to.

Government Assistance to Schools of Mines.—The Mines Department of New Zealand has imported from London, for the use of the schools, chemicals and apparatus to the value of about £400. It has also procured from Germany eleven collections of ores, rocks, and other minerals for distribution among the schools of mines. Each of these collections cost about £35, and includes 200 specimens of metallic ores, 50 specimens of rocks and 30 specimens of minerals that accompany the metallic ores and indicative of the same, besides an assortment of minerals to show degrees of hardness, and 110 samples for blowpipe testing, with blowpipes for same.

The Petrolia Oil Wells.—The wells are drilled 4½ inches in diameter, and where casing is put down it is rimmed out ¾ or ½ of an inch, the casing being 4½ inside and 5½ inches outside diameter. The hole is put down in about five or six days, and costs from \$150 to \$160. In the early days the cost ranged from \$1 to \$3 per foot, and the time occupied from two to six months. Wooden rods are now used altogether instead of cables, a steel drill 3½ inches in diameter and 25 to 30 feet long being attached to the lowest section. Two shifts of three men each form a drilling gang. These Petrolia drillers are very expert, and are called for all over the world, much work being done by them in Europe, Asia and Australia.

JOHN J. GARTSHORE, TORONTO, NEW AND SECOND HAND Rails and Cars for Tramways.

SOME GOOD CARS NOW ON HAND
FOR SALE CHEAP.

E. E. BURLINGAME'S ASSAY OFFICE AND CHEMICAL LABORATORY

Established in Colorado, 1866. Samples by mail or express will receive prompt and careful attention.
Gold & Silver Bullion Refined, Melted and Assayed, or Purchased.
Address, 1736 & 1738 Lawrence St., Denver, Colo.

W. de L. BENEDICT, E.M., Mem. Am. Inst. Min. Eng. Mining Engineer & Metallurgist, Reports on Mines and Mineral Lands. **PHOSPHATE A SPECIALTY.** 32 LIBERTY ST., NEW YORK.

FOR SALE DYNAMO AND ENGINE

One 6 h.p. Engine No. 1099, manufactured by E. Leonard and Sons.

One 25-lamp Dynamo.

Above machinery having never been in use is entirely new. For particulars apply to

A. B. C.

Mining Review, Ottawa.

ALL KINDS OF RUBBER GOODS for MINING PURPOSES MANUFACTURED BY THE GUTTA PERCHA AND RUBBER MFG. CO. OF TORONTO, 43 YONGE STREET, TORONTO.

Steam & Air Hose, Rubber Bumpers and Springs, Fire Hose, Pulley Covering, Rubber Clothing & Boots.

Chemist or Assayer.

The advertiser will be open to engagement about September 1st prox., either as Chemist or Assayer (or Assistant). Has pursued during past four years the "Faculty of Applied Science" course of studies and laboratory work (Chemistry, Assaying, Geology and Mineralogy, etc.), in the "Department of Practical Chemistry" of McGill College, Montreal.

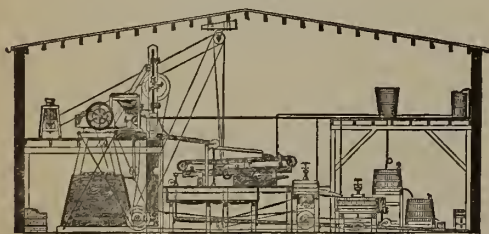
References and other information on addressing

WM. SMAILL, B.A. Sc.

P. O. Box, 1554, Montreal.

Charles M. Rolker, — LESSEE, — New York Ore Milling & Testing WORKS.

Office, - - 18 Broadway, New York.



Cable Address:—PHAFTRY, New York.

Consulting Mining Engineer.

Examinations made and reports rendered of mines and mining property, metallurgical works and processes.

Ores can be practically tested by any known process and the necessary plan of reduction determined. Works are complete in every respect for practical testing of Gold, Silver and Concentrating Ores and Tailings. ANALYSIS of ores and furnace products, etc.



SEALED TENDERS addressed to the undersigned, and endorsed "Tender for supplying Coal for the Public Buildings, Ottawa," will be received at this office until FRIDAY, 23rd inst., at noon.

Specifications can be seen and forms of Tender obtained, on and after Friday, the 16th instant, at this office, where all necessary information can be had on application; also at the office of James Nelson, Architect, Montreal, and at the Dominion Public Works Office, Post Office Building, Quebec.

Each tender must be accompanied by an accepted bank cheque for the sum of \$300, made payable to the order of the Honourable the Minister of Public Works, which will be forfeited if the party decline to enter into a contract when called upon to do so, or if he fail to complete the work contracted for. If the tender be not accepted, the cheque will be returned.

The Department will not be bound to accept the lowest or any tender.

By order, A. OBEIL,
Secretary.

Department of Public Works,
Ottawa, 13th May, 1890.

LEDoux & COMPANY, 10 CEDAR ST., NEW YORK, Engineers, Metallurgists & Assayers.

Public Ore Sampling & Storage Works

All the principal buyers of furnace materials in the world purchase and pay cash against our certificates of assay, through New York banks.

By special permission of the Secretary of the Treasury of the United States, cars of ore or copper matte passing through in bond can be opened and sampled at our works.

Consignments received and sold to highest bidder. Send for circular giving full particulars.

Mines examined and sampled. Assays and Analyses of all kinds.

NATIONAL COLONIZATION

Lottery!

UNDER THE PATRONAGE OF

THE REV. FATHER LABELLE.

Established in 1884 under the Act of Quebec, 31 Vict., Chap. 36, for the benefit of the Diocesan Societies of Colonization of the Province of Quebec.

CLASS D.

DRAWINGS ON THIRD WEDNESDAY IN EVERY MONTH AT 2 P.M.

Prizes value \$50,000

Capital Prize: 1 Real Estate worth \$5,000.

LIST OF PRIZES.

1 Real Estate worth	\$5,000	\$5,000
1 Real Estate worth	2,000	2,000
1 Real Estate worth	1,000	1,000
4 Real Estates	500	2,000
10 Real Estates	300	3,000
30 Furniture Sets	200	6,000
60 Furniture Sets	100	6,000
200 Gold Watches	50	10,000
1000 Silver Watches	10	10,000
1000 Toilet Sets	5	5,000
2307 Prizes worth		\$50,000

Tickets, \$1.00!

Offers are made to all winners to pay their prizes cash less a commission of 10 p. c. Winners' names not published unless specially authorized.

A. A. AUDET, Secretary.

Office: 19 St. James St., Montreal, Can.

The Canadian Mining Review

CONDUCTED BY . . . B. T. A. BELL
OFFICES:

UNION CHAMBERS, 14 METCALFE ST.,
OTTAWA.

Vol. IX. JUNE, 1890. No. 6.

The Report of the Royal Commission on the Mineral Resources of Ontario.

Canadians have become so used to reading ancient history and obsolete explorations and statistics in Government reports, that it is a genuine surprise to peruse the work that bears the above title, and to find it, in the main, fresh in its data, practical in its investigations and wise in its conclusions. Taken as a whole it might be said that no work has ever been issued of such vital importance to Canada; for its treatment of the mining industries is so minute in its investigation and far-reaching in its application, that its information and suggestions are capable of yielding untold benefit to the whole Dominion of Canada. To the Government of Ontario is due the credit of instituting this commission of enquiry, and of setting an example of intelligent research which is a model to all Governments, and which even the Geological Survey of Canada might emulate with profit.

As our readers would see from the summary published in our last issue, this Commission held sessions in 37 places, and examined 164 witnesses under oath. The Report derives great value from the statement of the views of these practical men in their own words, giving the reader the opinions of those best qualified to judge of the condition of each industry, while the summarizing of these voluminous and sometimes conflicting statements is performed with admirable skill and wisdom. This work refutes the oft-made assertion that no good can come out of Government undertakings, and that men can only work effectively under the stimulus of trade competition. It is difficult to see how private enterprise could have made more thorough examination of the various subjects treated, or have reached more definite conclusions. In this case certainly the existence of a Government Commission has been justified.

After an important introduction, a fairly valuable condensation of geological knowledge is given in terms suited to the ordinary reader; then follow descriptions of the various mineral resources of Ontario, and one is amazed at their extent and importance. The list of those specially investigated include iron, gold, silver, copper, nickel, building materials, marble, clay, charcoal, gypsum, phosphate, lead, mica, natural gas, petroleum, platinum, plumbago, salt, zinc and arsenic. Statistics of each industry are given, and the difficulties that each has to encounter are pointed out and discussed. The mining laws of the principal European and other countries are collated in a most instructive manner,

and wise deductions are made from their suggestions. The smelting of ores receives attention in a whole section, and the closing portion gives attention to "Measures for aiding and encouraging Mineral Development." Among these are, the establishment of a Provincial Bureau of Mines under control of a geological officer (who must be a practical mining engineer), the founding of provincial and local museums, the collection of mining statistics and technical instruction in schools of practical science. In an Appendix many valuable papers by eminent writers give valuable information upon the minerals referred to in the Report, with instruction upon methods for their determination and treatment. An exceedingly important paper treats of technical instruction, and gives information about the leading mining schools and museums of the world. This excellent compendium of information closes with a glossary of geological and mining terms, and carefully arranged indexes, giving reference to all the names of witnesses and to general topics. The lion's share of the work in its preparation fell upon the shoulders of the painstaking and hard working Secretary, Mr. Archibald Blue, and the public is largely indebted to him for much of the thoroughness of the compilation.

Elsewhere we notice in detail some of the main features and recommendations of the Commission. Our remarks on the consideration given to our iron ores and interests are however unavoidably held over until a future issue.

The Report on the Mining Laws of Ontario.

Much diversity of opinion existed among the witnesses examined by the Royal Commission on the mineral resources of Ontario with reference to needed changes in mining laws and regulations, but there were a few points of general agreement which deserve notice. It is evidently desirable that the prospector and discoverer of minerals, who is usually a poor man, should have the opportunity to work his finds, and for this purpose the sale of small locations, or the lease of lands upon royalty, is recommended by many witnesses. The monopoly of land by speculators is felt to be a great hindrance to development, and all agree that ownership should involve compulsory working. Men are ready enough to spend money in the expenses of operating mines, but the preliminary outlay of a large sum for the privilege of possessing a location for what is usually a somewhat doubtful experiment acts as a serious deterrent upon enterprise. The evidence given by the representative of the CANADIAN MINING REVIEW sums up the situation in these words: "I think our mineral lands should be reserved by the Crown. I think the present system of selling lands unconditionally is opposed to the development of the country. Development to a certain extent every year should be compulsory. Any mining regulations which permit the acquisition and control of large areas of land upon payment

of a merely nominal price is undoubtedly a most favorable arrangement for capitalists and speculators, but it is one which in every sense is opposed to the best interests of the people at large. At present, extensive districts are locked up in a few hands, and no one is permitted to operate upon them unless he can afford to purchase the land at an immense advance upon its cost. If capitalists were permitted to lease upon royalty just so much land as they could work, and only for such periods as they continued to work, and if the poor prospector could lease the area on which he had made a valuable find and be at no expense beyond the cost of working, then we should see a vast increase in mining matters; the revenue from royalties would be a constant and important source of income, and the people would cease to barter away their natural rights for a paltry mess of pottage."

The Commission deems reservation and royalty impracticable, owing to the influence of the United States system, and the fact that Ontario has already gone so far in the opposite direction. But surely a bad example and wrong practices are not a fair argument against reform. It is in this and a few other features, that the otherwise most admirable Report is least satisfactory. It says: "The best and perhaps the only remedy for the evil would seem to be that which has been adopted in New Zealand and South Australia, viz., the resumption of such unworked lands as are believed to be valuable for mining purposes, upon payment of a reasonable compensation, and holding them for re-sale, subject to developmental conditions." This applies to lands already sold, but there seems to be no reason why the unconditional sale of mineral lands should be continued. It is a policy at variance with the ideas of nearly all advanced thinkers, who maintain that the land and its treasures belong to the people at large, or, as we say in a monarchical country "to the Crown," and should only be parted with for "occupying use," and on terms that will give perpetual income to the nation. The Commission has rendered a valuable service in collecting the mining laws of the world, and a careful study of that portion of the Appendix may aid the suggestion of the wisest policy for Canada to pursue.

Attention is given in the Report to the laws relating to underground boundaries, the health and safety of miners and their claims as wage-earners, and to forest fires in mineral districts,—all important matters and worthily considered. The influence of this Report should be mighty in the direction of legal reform and wise legislative enactment.

Aids to Mineral Development.

The conclusions of the Royal Commission, resulting from their comprehensive investigations into the mineral resources of Ontario, must necessarily be regarded with great interest, and are entitled to the respect due to earnest and intelligent effort. The abolition of tariff restric-

tion between Canada and the United States is evidently regarded by them as the great desideratum, but there are many other improvements, which are at once within reach, that would be of vast advantage to the country. The Report mentions four ways in which valuable service may be rendered by the provincial government of Ontario:—

1. By a geological survey of the province with particular reference to its economic minerals.
2. By establishing a museum of minerals and mineral products.
3. By collecting and publishing yearly statistics of the mining and metallurgical industries of the province.
4. By provision for education in engineering, mining and metallurgy.

The purpose of a geological survey is stated to be mainly the development of mineral resources. A general survey of the country is now being made by the Dominion, and the time has come for the province to take up the work in more thorough and systematical detail, and to form a Provincial Bureau of Mines. The object of this Bureau should be not only to collect information to be stored away in its archives, but to diffuse knowledge, give useful advice and secure the promotion of industry. Complaint has been made that the researches of the Dominion survey have been too carefully guarded from the inspection of the public through a dread of favoring individual pursuits, and it seems important that all the knowledge obtained should be made available for every one who has the enterprise to ask for it. The efficiency of this Bureau must altogether depend upon the person in charge of it, who should not merely be a geologist, but also a well educated mining engineer, in possession of thoroughly practical experience in mining matters, well qualified to instruct owners as to the best means of opening their mines, and of utilizing and marketing their products, and also able to recommend modifications and improvements in mining practices—a man of weight and authority who will be respected, not one who will oppress enquirers with an outpouring of technical gibberish, but one who can impart practical common-sense ideas.

Museums of minerals are found to be serviceable means of instruction to prospectors and other persons interested in mineral development, and when in charge of officials able and willing to give information, valuable service can be rendered in the direction of research, and costly mistakes may be avoided. "It has been estimated that in Great Britain the money saved from the indiscriminate and fruitless search for coal alone where there could be no hope of finding it, such as had formerly gone on, has been more than sufficient to pay the whole cost of the exhaustive geological survey of the kingdom." We have record in this report of a cargo of pyroxene having been shipped to England under the misapprehension that it was phosphate. The influence of the Bureau and museum would tend to prevent such occurrences.

By making returns of mining statistics com-

pulsory, and by a prompt and intelligent compilation of them, great service might be rendered. Investment and operation would often be encouraged were accurate information obtainable as to the past and present conditions of industries.

The information collected with regard to schools of technical instruction is one of the most valuable features of the Report, and should stimulate the people of Canada not to be behindhand in the education of their youth in those departments of natural knowledge and technical skill which all progressive countries are now giving attention to. The cultivation of classical learning may be of value in increasing the culture of the wealthy classes, but what the youth of Canada need is not so much to know the mythologies of Greece or the history of Rome as to become aware of the natural resources of the country and the best means of utilizing them. By attention to these recommendations a mighty stimulus would be given to industrial progress, for "the most legitimate means by which people can really enrich themselves is to extract wealth from mother earth direct," and while many natural supplies are destined to decrease, such as timber and fisheries, the minerals furnish an unlimited source of wealth, and it is only by the well directed and intelligent effort that comes from observation and study that economic production becomes possible.

Minerals and Politics.

It would hardly be expected that a treatise on the mining industries of a country would prove to be a medium for political instruction, but the report of the Royal Commission on the Mineral Resources of Ontario contains the most conclusive array of facts and opinions in favour of Commercial Union or Reciprocity with the United States that has ever been presented to the Canadian public. It will wield a powerful influence from the circumstance that its compilation is entirely free from the influence of party politics, and is solely inspired by the earnest and unbiased consideration of economic necessities. The opinions expressed are not those of the Commission primarily, but of the numerous witnesses who were examined throughout the whole range of the country from Ottawa to Rat Portage. The report says: "At every point the Commission met with evidences of the great importance of securing wider markets. Everywhere the witnesses examined either felt impelled to allude to the importance of this matter of securing access to other markets or fully admitted its importance when allusion was made to the subject. Differences of opinion upon the questions of establishing mining schools, granting bonuses to promote iron production, changes in the mining laws, everything else in fact were in all cases developed; but upon the question of the desirability of obtaining free access to the American markets for our mineral productions there existed absolutely no difference of opinion so far as we could judge

among men interested in mining enterprises, except in the case of those interested in petroleum, and in one solitary instance in the case of a producer of salt. With the consciousness on the part of the intelligent men interested in mines, whom we met from Ottawa to Rat Portage, that with boundless mineral resources and a market the limits of which were exceedingly narrow, we were cribbed and dwarfed in our attempts to make developments, the cry everywhere was 'Give us the American markets; break down the barriers that separate us from 60,000,000 customers at our very door!' Whether this desire may possess the farmer, the lumberman and the fishermen or not, it certainly awakens the earnest longings of the mining population of Ontario."

The report goes on to show that the two countries are geographically one, and points out the natural conditions favouring commercial intercourse. "The energetic zone of North America may be said to be between the 38th and 48th parallels of latitude," and Ontario occupies a central position in its midst, with control over means of transit by land and water of incalculable value to both countries. The people of the two countries are essentially homogeneous in blood, and the populations are largely commingled. By restrictive tariffs on both sides Canada is placed in a false economic condition, and her experience under the reciprocity treaty proves conclusively the desirability of removing the barriers of trade. No department of business has experienced more painfully "the effect of commercial hostility and ruthless repression by tariff enactments" than has been done by the mineral industry. In turn each department is surveyed. The stagnation of the iron industry is pointed out, and the glowing picture of its probable development under free trade would arouse the enthusiasm of every lover of his country. Copper and nickel are next shown to be depressed by the United States tariff, by the United States tariff which reduces its price, and by the Canadian tariff that increases the cost of supplies. It is stated that the salt field of Ontario embraces an area of about 1,200 square miles, "the brine is the strongest and purest known, and the quality of salt produced is excellent." "The free admission of salt to the American market with free coal for fuel might speedily double our salt product, and secure continued and rapid increase beyond that point." Mountains of marble and quarries of building stone of great excellence are described, with easy access and cheap transportation to all the cities and towns of the lake region. "The duty alone has prevented the growth of trade in this direction."

After enumerating many of the direct hindrances to trade arising from the exaction of duties, the Report goes on to mention that the measure of repression is not to be estimated merely by the amount of money paid, but that consular certificates, custom house entries, disputes with appraisers combined with espionage

and exactions of officials who need care little for public opinion, constitute a system of vexation more appalling and deterrent to many men of business than are the mere duties levied. The testimony of the practical men who were examined must be read to secure a full appreciation of the vital necessity of free trade with the United States to the full development of our mineral industries.

The Report lays equal emphasis upon the repressive effect of Canadian duties upon mining machinery and supplies, and it is probably owing in great measure to these investigations that the Dominion Parliament at its last session made some arrangements for free importation of mining machinery. This action is the admission of a principle which, if consistently applied, would sweep away all tariff restrictions, and permit our natural resources to seek full development unhampered by artificial restraint.

The Commission carefully avoids vexed questions of party politics not of a purely economic nature, and there is not a word in the Report calculated to offend the loyalist or to give support to the annexationist. But it looks the facts squarely in the face, and deals with questions in a purely practical manner. This section closes with the following remarks: "The vast increase in mineral production in the United States has been pointed out. A state of great activity is the characteristic of the development of mineral resources in that country. In Alabama, Georgia, Tennessee, West Virginia, Virginia, Kentucky, Arkansas, and other States, scores of millions have been recently invested, cities are springing into existence, railway lines are being constructed, furnaces erected and great strides in development made. Why should Canada lag behind in this career of development? Why should the great tide of enterprise and business activity sweep by and leave us untouched? The tariff well serves like a wing dam to direct the current from us. Remove the dam and the current will reach us in full force. To the wealth and the restless activity of the United States we must look to a large degree for the capital and the skill to develop our large resources of gold and silver, nickel, copper and iron. Now we are looked upon somewhat as Siberia is; a land possessed of minerals, perhaps, but foreign and far away. More than one-half of our mining capital is now American, but it represents only a small fraction of the amount that would speedily seek investment in Ontario if the two countries were commercially one. The influence this change would exert would probably be felt in a more marked degree in the development of the silver and gold mines of north-western Ontario than even in the more seriously tariff-burdened industries of iron, copper, salt and structural material production.

"Examination into the character and extent of the mineral resources of Ontario shows even now, when we are only at the threshold of discovery, that they are practically without limit in extent and value. As to the best means of development, we must pick up the courage to make

that considerable degree of progress which present conditions will permit, and we must work and hope for the coming of the day when the war of the tariffs shall be a thing of the past, and we shall be able truthfully to say—

'No pent up Utica contracts our powers,
But the whole boundless continent is ours.'

Suggested Smelting of Canadian Copper and Nickel Ores in Ohio.

Mr. S. J. Ritchie, President of the Canadian Copper Company stated in his argument, before the Ways and Means Committee, for the free admission of nickel ore into the United States, that if this was done his company was favourably disposed to utilize the natural gas in the neighbourhood of Findlay, Ohio, for the manufacture and treatment of these ores—indeed, he said, "we are contemplating bringing in all our ores to that place to be smelted."

The Canadian Government has treated this company with the utmost liberality, having permitted it to import its machinery and coke for fuel free of duty. And in return what benefit are we to receive from these wonderfully rich mines? Absolutely none whatever, except, perhaps, in the employment of the men engaged at the mines. Large reduction and refining works for utilizing these ores will, according to Mr. Ritchie, be established in Ohio. The duty of the Dominion Government is plain. The American duty of 15 cents per pound upon the nickel contained in the ore and matte imported from Canada, and a like duty on the nickel oxide forced the Canadian Copper Company to establish its smelting works at the mines. Canada must now retaliate and levy an export duty on these products to a similar extent. Before doing so, however, it will be well to wait until Mr. Ritchie's scheme materializes. Perhaps it is only a bluff.

Artificial Foundations and Method of Sinking Through Quicksand.

Paper read Midland Institute of Engineers.

The depth of sand to be sunk through was about 18 feet, and it was wet from the surface throughout. The object was to sink the tubing to the solid metals on which the sand rested without withdrawing the water, so as to avoid subsidence of the various surface erections. Supports for the balks of timber for lowering screws were erected of sleepers in the form of chocks. On these chocks two trussed logs, each 17 inches square and 53 feet long, rested. Four transverse beams, 14 inches square, set in pairs, rested on the main balks, and to these were attached the lowering screws, 3 inches diameter, and four in number, which controlled the descent of the tubing. The water in the pit served as a guide to show any deviation of the tubing from the vertical. If such occurred, it was rectified by manipulation of the screws. When the friction arrested the descent of the tubing an excavation was made round the sides, and the sand therefrom thrown to the centre of the pit. When the bottom of the quicksand was reached the water was pumped out, the cutting edge of the tubing was rested on wall plates, and the sinking continued through the water-bearing strata, the bottom of which was reached at 54 yards deep. The water was then tubed back by a cement lining 3 inches thick behind brick walling. While sinking through water-bearing strata the water was pumped by two pulsometer pumps, suspended in the shaft. The feeders of water gave off more than 1000 gallons per minute. Boiler foundations were formed first of concrete, 7 feet thick, put on in layers 15 inches thick, on a bed of old sleepers. On the top of the concrete, rails of 70 pounds per yard were laid longitudinally and transversely, 4 feet 3 inches apart, and the ends of the rails bent alternately upward and downward, so as

to embrace the concrete and stonework above and below. On the top of the concrete was built a layer of stone in blocks, 6 feet by 4 feet 6 inches by 6 inches. The concrete and stonework were embraced by iron rails round and round horizontally, and so bound together as to form a foundation of uniform support. On this foundation was built the brick boiler-seating, with air passages above the stone work, with the object of preventing heating of the concrete and destruction of the cement. The engine-houses and workshops were built on beds of concrete 6 feet thick. No evidence of unequal settlement was observed. The results of a few tests of the strength of pit props are appended, showing very great variations in strength of trees of exactly the same size and length. Props 6 inches in diameter and 6 feet long supported pressures varying from 19 to 61½ tons, while chocks of elm, formed of pieces 24 inches by 6 inches by 6 inches, collapsed under strains of from 43 tons to 60 tons. There is also a short description of a method of sinking pillars through sand, in use at Calais Harbor Works. In forming dock walls there, the plan was to sink pillars in the sand by excavating the sand with water jets, and pumping it out suspended in the water. The pillars, 26 feet square, of rubble masonry set in cement, were built with an octagonal hole, 8 feet in diameter, in the centre, the bottom of which tapered outward and formed a kind of cutting edge. The pillars were built to such a height as was necessary to sink them—about 12 feet to begin with—and when cement was set sinking began. Jets of water, under pressure from flexible pipes carried down each angle of the octagonal central opening, were directed against the sand under the edge of the pillar, care being taken so to direct the jets of water as to keep the pillar sinking vertically. A centrifugal pump raised the water again to the surface, and with it the sand in suspension.

English Colliers at Home.

The best time to get the colliers at home is Sunday, for then is he not arrayed—to his own taste—like Solomon in all his glory? On week days, dirty with coal dust and wet with perspiration, he takes little heed of fine raiment, except perhaps after leaving the mine, to change his grimy working garments for something rather different; but on Sunday, when it may be said he is "at home," the good wife brings out all her man's fairest garments. On a Sunday morning, when the bells of the little Anglican church are clashing out defiance to the band of the local branch of the Salvation Army, you may see Geordie and his mates, ranged in grandeur, squatting in the cramped posture of the miner, with back against some wall not far distant from the public house where swings a brilliant signboard with an impossible lion. His costume, be the day the warmest in summer or the coldest in winter, never varies. He has a rough pea-jacket, thick and substantial, pants of imposing pattern, well shod boots, and, as the special and peculiar grace of his costume, a huge muffler twisted round his neck, tucked under the waistcoat and shooting out at its extremity. With a pipe in his mouth and the familiar dog "close handy"—an animal apparently half bull-dog, half Italian greyhound—he is furnished for the Sabbath. A story is told of a northern collier which accentuates the "clothing" aspect of the dog question. There had been a match between some dogs arranged at the town and a great deal of interest in it was excited among the miners. One sportsman was noticed to be absent, and, subsequently a friend meeting him, inquired the reason, "Now, Geordie, ha' ye na been ta toon." "Nay and ha na been ta toon, dawgie is deed, an a man looks so naked like gan to toon wi'out a dawg." But he who would see the pitman in his glory should see him and his 'missus' at a feast. One gains from such an experience a new conception of human possibility in the matter of consumption—liquid and solid. The preparations for such a banquet are on the grand scale; their bread and butter has no place in such a Broddingnagian feast. The cake, plummy and solid, takes rather the form of an ornamental tile than a "genteel slice"; tea, brown and strong, flows by the quart. "Ye mun fill thyself afore thee gets oop," says a brawny collier to his wife as he passes her the thirteenth cup of tea. And she does. There is no affectation among the good people; they mean to have a feast and a feast it is. A favorite form of entertainments in these parts is a "ham tea," where ham, harmony and religious addresses are combined. One of the most original of these quasi-religious gatherings occurred not long since in a little colliery town up north where the entertainment extended over two evenings. The first evening a grand performance of the Parable of the Prodigal Son was given. In order to make the representation thoroughly realistic a live calf was brought on the stage preparatory to being slaughtered in celebration of the return of the Prodigal. As the calf, bleating innocently and wholly unconscious of its approaching fate, was led off the stage, the chairman of the gathering came forward and announced that on the following evening a grand "veal and ham tea" would be held as a supplement and sequel to the parable.—*Cassel's Journal*.

Our Portrait Gallery.

[A series of portraits and biographical sketches of Canadian mining engineers, mine managers, inspectors, geologists, explorers, etc.]

No. III.

The Late William Plummer, Mine Manager of the West Canada Mining Company.

In the death of Mr. William Plummer, M.E., on the 18th ult., Canada loses one of her most prominent pioneers in the progress of mining in this country. His name is probably unfamiliar to many of the younger generation of mining engineers, owing to his having retired some years ago from all connection with the profession; but it is still a household word in the district of Algoma, the scene of his most active endeavors in the development of Canada's mineral riches, and its mention still meets with warm recognition in many an out-of-the-way corner of the continent by those who were amongst the "gang"—now scattered far and wide—who worked under him at Bruce Mines.

Mr. Plummer was born in 1819 at Mary Tavey, near Tavistock, in the County of Devonshire, England. This pretty little village is situated near to the line which divides Devon from the famous mining district of Cornwall.

On his mother's side he was connected with one of the old mining families of that district, which fact probably influenced him to early turn his attention to the subject, so that he studied his profession under the most favorable auspices in that classic district, famous all over the world since the time when the Phoenicians traded there for tin, and which has ever since been the cradle and training school of some of our best and most practical mining engineers and miners.

Here he served a thorough apprenticeship to his chosen subject, not only studying the scientific principles which underlie it, but by practice becoming adept at their successful application to the solution of the manifold and varied problems constantly confronting the mining engineer, and that in a district where the experiments and experience of centuries had brought the art to a high pitch of perfection, and where might be studied fully the characteristics of mineral veins and deposits as laid bare by the most extensive workings and thorough exploration.

Having thus acquired the necessary training and experience, he early in his career became connected with the well-known London mining firm of John Taylor & Sons, with whom he remained actively associated until he finally abandoned mining, and for whom he successively managed a number of mines in various parts of the British Isles before coming to this country. His first independent charge was at Castleward Mine, County Down, Ireland, and subsequently he had charge amongst others of the Goldscope

Mine near Keswick, Cumberland, Eng., and of the Lackanmore mine in County Tipperary, Ireland.

In 1859 he came to Canada as manager for the Wellington Copper Mining Co. (subsequently reorganized and known as the West Canada Mining Co.), bringing with him a wide experience of mining operations and mineral deposits. The veins which had been acquired by this company were adjacent to and a continuation of the group on which the old Bruce Mines had been operated for some years previous by the Montreal Mining Co., and were known as the Wellington and Huron Copper Bay properties.

Here he found many difficulties to be encountered in addition to those naturally incidental to

calling for the most desperate efforts to meet the difficulty, whilst at another a bush fire swept away nearly the whole of the prosperous village which had grown up round the mines. Further, if after the close of navigation any necessity arose for a visit to the outside world of civilisation, a tramp with dog teams and on snowshoes of some 250 miles around the shores of Lake Huron had to be faced, all combining to produce a state of things the full inconvenience of which can hardly be realised at the present more favored time.

Notwithstanding all this, owing to Mr. Plummer's experience and indefatigable exertions, extensive mining operations were inaugurated and carried on for years. The Company subsequently acquired the adjacent property of the Bruce Mine, so that all three mines were carried on under the same management, and at the zenith of their prosperity gave employment to a force of over 370 men and boys, whilst it was then estimated that the operations supported directly or indirectly some 1,800 people, of whom 1,500 resided in the village adjacent to the works.

After a period of some nine years of anxious and arduous effort Mr. Plummer began to find his health giving way under the strain, and resolved to take the position, offered him by the Government, of Visiting Superintendent and Commissioner of Indian Affairs for the Western District, so resigned his charge at the Bruce Mines in 1868. For five years he remained in his new position, residing on Manitoulin Island, being however moved to Toronto in 1873, where he was given the Superintendency of the Central District. In this new sphere also, in his treatment of the of the Indians and their affairs, he met with the same success that had characterised his former career, several kindly tokens testifying to the regard they had for him. In 1883 he was removed from Toronto to Ottawa to take the position of Commissioner of Indian Lands which he held until 1887 when his rapidly failing health, the seeds of which had been sown at Bruce Mines, forced him to seek superannuation. After two years of well earned rest he passed away on the S.S. Orinico whilst returning from Bermuda, whither he had been in search of alleviation.

The influence the operation of so extensive and long-continued an undertaking as the "Bruce Mines" group would have on the development, both mineral and otherwise, of a new district can hardly be over-estimated, and in this connection as well as in his later career Mr. Plummer rendered signal service to the land of his adoption, in whose progress he always took the keenest interest and an active part. He reported on and was instrumental in bringing into notice a great number of mineral deposits, all the way from the silver district of Port Arthur to the Eastern



THE LATE WILLIAM PLUMMER,
Mine Manager of the West Canada Mining Company.

the opening up of new mines. These were due to the wild and unsettled nature of the district in those days. Communications with the far distant settled parts of the country were only by water, and were, of course, therefore only available for the summer half of the year, and besides were even then bad and uncertain. So that not only was there constant difficulty in shipping away the product of the mines, but their supplies of material and provisions were also often jeopardized by the sudden and violent lake storms, so that at times the question of daily bread was often a cause of the greatest anxiety. At one time the whole winter's supplies failed to arrive,

Townships of Quebec, many of which are now known by names familiar to all Canadian miners, his reports being notable for good judgment and that spirit of fairness characteristic of all his actions. He leaves behind him a large family to carry out the traditions and motives he inculcated, so that the name is already connected with success in banking, commerce and other lines in Canada, whilst one son, by his eminently successful career as a mining engineer in the United States, still keeps up the credit of the name in connection with our beloved profession.

Although not actively participating in mining matters Mr. Plummer kept up his interest in it till the end, one of his last actions being the giving of valuable evidence before the recent Royal Commission of Enquiry into the Mineral Resources of Ontario.

His connection with the early political events at and subsequent to Confederation caused him to be widely known amongst the prominent men of Canada, amongst whom he had many warm friends, and in his death Canada loses a skilful miner, a loyal citizen and a kind and true-hearted gentleman.

Our portrait sketch of Mr. Archibald Dick, Inspector of Mines, Nanaimo, held over to the death of Mr. Plummer, will be published in our next issue.

A Trip to the Lieres Phosphate Mines.

(By Capt. Robert C. Adams, Montreal.)

It is considered a fortunate circumstance when business and pleasure can be combined, for business is usually drudgery, and pleasure that has not the element of service soon palls. There are few better opportunities of realizing this desirable condition than that which falls to the lot of one who has occasion to visit the phosphate mines of the Lieres River. Here nature has heaped together attractions which would make the fortune of any similar locality in Europe; and the industries of man have formed interesting centres amid the beautiful framework.

An afternoon in Buckingham affords hours of rare enjoyment. Walking to the riverside one comes to the saw mills of Messrs. Ross Brothers. There can be seen the great logs that have been cut during the winter 150 miles away and have floated down the stream, through cascades, down slides around the fall, and finally been gathered within the boom where, when their hour for transformation has come, they are guided on to the grip of the endless chain that carries them up to the mill on to a travelling platform that moves them to the circular saw or the gang saws, changes them into boards and deals, and they float away down a narrow chute for three miles to be piled up to dry and await shipment. Across the river are the mills of James McLaren, Esq., where similar work proceeds; and near by is his elegant mansion and attractive grounds overlooking one of the finest cascades in America. Between these mills is stretched an artificial dam over which the water pours in a clear sheet; but for a short distance only nature has here erected barriers of rock that break up the torrent, which thence rushes with tremendous roar and indescribable confusion through a narrow gorge. Such a tumultuous rush of waters is rarely to be witnessed, and it is hard to repel the fascination that would tie one for hours to the spot watching the ever varying forms that the cataract assumes as its torrents pour into the deep rocky gulfs and boil up again leaping aloft in myriad sprays.

Half a mile higher up the river is another dam and a cascade of great beauty, which, but for the majesty of the first would be deemed a sufficient attraction. Here has been erected a pulp mill. The spruce logs being cut into short lengths are held against a revolving plane that takes off the bark; after which they are pressed against grindstones flooded with water and are ground to pulp. This being fed to a paper machine is pressed into sheets and folded up ready for sale to the manufacturer of paper. Thus trees, brooks and stones combine to aid literature, fulfilling in another sense Shakespeare's words:—

"And this our life, exempt from public haunts,
Finds tongues in trees, books in the running brooks,
Sermons in stones and good in everything."

This beautiful spot has its charms dimmed by tragedy; for the villagers tell how twenty years ago a minister, burdened with the support of a crippled sister, tied a stone to her leg and drowned her through a hole in the ice.

The steamer *Agnes* is under command of Capt. George Bothwell, a skilled veteran in the intricate navigation of the Lieres River and the possessor of a genial disposition which is greatly appreciated by the passengers on this river omnibus, who require to get on and off at all sorts of odd places where the boat must run her nose into the bank or drift broadside to the shore while the passengers skip to and fro on the perilous shifting plank. Starting on the *Agnes* in the morning a most interesting trip up river awaits the visitor. The stream is narrow, and at first the country is undulating and of a good farming character; but further on the rugged hills arise and tell of stores of minerals awaiting the search of the adventurous prospector and the toil of the hardy miner. These woods skirt the banks and cover the hills, save where the farmers' clearance or the forest fires have made their mark. For picturesque beauty there are few river panoramas that will vie with this stretch of 25 miles, which culminates in one of the most attractive scenes on this continent—the High Falls.

About 8 miles above Buckingham the first sign of the phosphate mines appears in the new wharf of the lately opened Squaw Hill Mine, where English capital is being intelligently applied by Mr. Smith, who has come out from London to superintend operations. The Emerald Mine then comes in sight with its many signs of activity and enterprise, buildings, derricks, tunnels, tramways and great rock dumps testifying to the vigorous work that has been done, and suggesting the thousands of tons of phosphate that have been sent to Europe from this famous hill. The Little Rapids Mine is passed, and the slow progress of the canal, building on contract for the government, is commented upon with the remark that the work is indeed *little rapid*. Next appear the new buildings of what is locally called "the London Company," where Mr. Pielsticker has made an enterprising start which deserves good success. The landing for the famous North Star Mine, that cleared \$30,000 last year, is now passed, and upon enquiring if the sale to English investors, reported six months ago, is completed we are told "the mine is sold but the sale is not finally consummated," an expressive statement of a condition familiar to all who have tried to dispose of mining properties. Now the bare Ross Mountain looms up and we are told that the adjoining Lot has just been bought by some eminent Dominion Legislators. Crown Hill and High Rock landings are passed, and on the opposite bank are seen the piles of white mica and feldspar from the Villeneuve Mine. This feldspar through the sagacity of Mr. J. Keith Reid has been brought to the notice of the pottery makers and is pronounced the highest quality found on this continent. The river being high with the coming down of the north water, the steamer proceeds on the unwonted passage of the long rapids. With a full head of steam and an axe on the safety valve she struggles against the impetuous stream and after an uncertain conflict slowly gains ahead and wins her way to smoother waters. Landing at the Portage, the visitors clamber up and down hill to the foot of the High Falls, but are interrupted by a timber chute down which torrents of water are passing and through which shower baths are falling. Only a few adventurous men and boys endure the ducking and gain the best viewpoint. Some of the ladies, deterred by the precipice, give up the effort to get full sight of the cataract; but a few people ascend the rocks, climb rotten ladders and scale the old timber slide. At last a point is reached too perilous to be ventured upon and all return save one couple. A rotten and slippery timber stretches over a deep ravine having jagged rocks at its bottom. The lady's heart beats violently and she fears to cross; but her escort going in front reaches his hands behind and with fervid clasp her faltering steps brave the fearful danger. A few thrilling moments of peril that seem to involve ages are followed by a bound to the solid rock and the fervid clasp is changed in direction and increased in intensity. Though the Lieres has its tragedies it also has its romances! Standing alongside this immense cataract with throbbing heart and pulsing view, contrasting conscious safety with the rareness of deadly peril, one gazes upon the wild waters rushing down into the great calm basin encircled by almost impenetrable forests and realizes that words fail to convey the emotions and impressions and is content to say with Moore:

"How fair though art let others tell
While but to feel how fair be mine."

Only a year ago another tragedy cast its shadow upon this marvellous scene. A highly esteemed young minister, in spite of warnings, ventured near the rapids and was drawn towards the falls. Finding escape with the boat hopeless he was seen to plunge into the water in a vain attempt to swim, but the remorseless torrent bore him to destruction. The body was afterwards found with not a bruise visible upon it.

A party of four decided to stay over at the phosphate

mines and explore the famous range of hills that has yielded the great bulk of Canada's export of the fertilizing rock. On her return down stream, the *Agnes* dropped the party at Crown Hill, and they teiled up the tramway to a height of 350 feet, but the city man declared it was 15,000 feet measured by effort. Here are the mines of the Canadian Phosphate Co. and a hearty welcome is extended by its representatives, Mr. Thomas Lyons, superintendent, and Mr. Merrill, shipping clerk. After a good supper, the comfortable chairs in the sitting room received the wearied forms and amid a cloud of smoke the ear is regaled with the facts and legends of the mine. As the frogs set up their evening refrain the superintendent tells of the Irish lady, who after her first night at the mine went to the frog pond with a big stick in her hand "to hit them little ducks when they put their heads out." Wire mattresses afforded unwonted luxury in a mining camp, and the next morning found the visitors ready to explore the mines. It was Sunday, and the superintendent most kindly devoted his leisure to the edification of the party. The various pits were visited and descended. It was found that they were worked with small boilers and hoists placed at each pit, the mining was done with steam drills and in some wet pits steam pumps were used. The ore as it came out was placed in cars and drawn by horses to the cobbing house, where a complete system of separation was well provided. The ore when ready for shipment was drawn to the brow of the hill and thence lowered in cars down the steep incline by a wire rope over 2,000 feet in length, made in one piece without a splice. All the arrangements were pronounced to bear the impress of skill and good judgment. Telephones transmitted orders to distant points and saved the expense of messengers; and every economical device that could be readily applied seemed to have been thought of. But it is not enough to have a well equipped mine; minerals are a desirable feature in a mining property, though sometimes not duly considered by speculators, who, if they can sell a mine, have no concern for its future. It was with interest therefore that the existence of large deposits of phosphate was observed and it was seen that the extensive preparations for handling the ore were warranted by its presence. The green apatite was found to occur in irregular bunches all through the rock, so that the whole mass was more or less permeated with it and the hillside must be quarried down, the amount of phosphate now being proportionate to the tons of rock removed. "It's all through the rock," said Mr. Lyons. "Sometimes you'll put a shot into bare rock and the pit will be all strewn with phosphate and you wonder where it comes from. But," he sadly said with candor, "sometimes it works the other way and you don't see as much as you expected to!" After Crown Hill had been explored and approved by the self-constituted inspectors, the party drove and rode to Star Hill, three miles distant, the famous mine formerly operated by the Union Co., but now owned and worked by the Canadian Phosphate Co. The big pit that has yielded so many thousand tons of ore has been abandoned and the immense rock dump testifies to labor in vain and sinking of capital. But other pits have been successfully opened and large surface shows are being worked. A good output is being secured and a prosperous future seems certain. After dinner had been provided by the courteous manager, Mr. Cameron, who has charge here under Mr. Lyons' general superintendence, a charming walk was taken for two miles through the deep forest, verdant with the freshness of spring, and as yet unvisited by the baneful mosquito or black fly, two mysterious plagues whose existence if satisfactorily explained by the theologian might unravel the riddle of the universe. New workings are seen a mile away, proving that the deposits of phosphate occur all along this mountainous range; and the walk is terminated at the Central Lake mine, where a great cutting has been made showing the same rich green streaked rock that characterizes all the workings of the district. The enterprising owner, Mr. S. P. Franchot, also manager of the famed Emerald mine, has brought a steam boiler and hoist upon the scene, a striking intrusion of civilization upon savagery as it stands in the midst of the seemingly inaccessible wilderness. It will doubtless bring to the surface large quantities of ore and demonstrate the richness of the ground.

Some pits showing good veins of phosphate were then visited on the adjoining Lots of the Anglo Canadian Phosphate Co. On the highest hill, at a little distance, their lofty derrick stands in the weird solitude awaiting the slowly approaching completion of the *little rapid* canal, which will permit steamboats to come to these lots by the drowning out of the Long Rapids, when supplies can be brought and phosphate transported more cheaply and work can be profitably resumed. Here is a wonderful view of hills and vales covered with deepest forests, except in one direction where a German colony has made clearance in a valley and secured prosperous farms and comfortable homes. Amid the wildness of nature this glimpse of man's effort and supremacy brought feelings of satisfaction and cheerfulness. Getting back to Crown Hill in a drenching rain, arrayed in borrowed

garments, fed on the succulent baked bean, cheered by strains of banjo and fiddle, enlivened by the dance (until a visitor's head is punched by the hanging lamp), warmed by gymnastic tricks and with circulation quickened by slaps from a miner's bootleg, this energetically spent "day of rest" ends in a night of repose. Monday morning the electric bell summons the outsiders of the party to rally at breakfast and a walk is taken up hill for half a mile to the justly renowned High Rock Mine, which year after year turns out its five or six thousand tons and like Tennyson's brook sings:

Seams may come and seams may go,
But I go on for ever!

The great dog Mousettaire, an immense St. Bernard, accompanies the party, but the High Rock collie thinks he belongs to the best mine and pluckily insults the Crown Hill intruder. A terrific dog fight ensues, soon joined in by a Newfoundlander, and the three dogs are mixed up in an indescribable medley and uproar of tumblings and yells. Now Mouse has Collie by the neck, then Collie has Mouse, by the lip and the advent of the black dog on the top of the heap occasions a new diversion. The row stops at last, nobody knows how; the combatants are collared and are told that phosphate dogs should not delight to bark and bite.

Mr. Twidell the clerk of the mine now politely takes the visitors in hand. The three bears in the great cage are visited and caressed and are found to agree better than the dogs. Then the seven drill Rand air compressor is seen to be working well, saying in its puffs, so miners assert, "a dol-lar a min-ute." The Cap Rock pit is descended, where a great vein has been followed to a considerable depth and large bunches of ore are to be seen here and there all along the lead at the back of the hill; being lowered down in the tramcar, the famous No. 11 Pit is visited, and here is seen a real mine with its tunnel, shaft and drifts in which the air drills with unearthly roar pierce the rock. Wonderful bunches of phosphate are examined and the verdict is passed that High Rock is good for many a long year. The cobbing house is visited and all the transport system surveyed by which the ore is hoisted up the hill in tramcars, which then run by gravity for two miles down the hill and dump into the barges. The party are told that a 12-drill Ingersoll air compressor is to be placed at the river for the sake of cheapness of fuel, and the power is to be carried in pipes two miles to the workings. The pipes above, it is said, will cost \$6,000. May the day of electric mining be hastened when a little wire will carry the power!

After dinner at Crown Hill and a general boat blacking the party are lowered down the incline which the city man declares is much shorter one way than it is the other. Then the *Agnes* appears and steams into a floating raft to receive the wanderers. They depart, profuse in their expressions of gratification of the courtesy received and the enjoyment experienced, but yet loudly complain at the exorbitant charges, for when asked for "the hotel bill" the superintendent replies, "A thousand dollars and I won't take a cent less!" Of course no such sum is to be found in the pockets of the visitors, and they are generously and trustfully allowed to depart without any seizure of their gripsacks for security.

The trip down river with the current is quickly made, in spite of numerous stoppages for passengers and goods. But the sights of the region have not been exhausted. The next morning a walk is taken in the slides along the river for three miles. The water having been turned out to permit repairs, a dry plank walk is afforded through pleasant groves and near rushing cascades until the Basin is reached, where the Lievres pours tumultuously down its last rapids to mingle with the waters of the Ottawa. Here are three mills for grinding phosphate. The latest, owned by Messrs. Lomer, Rohr & Co., of Montreal, has a new system of separation, devised and erected by the Messrs. Taylor, father and son, who politely explain its workings. It appears that the long-felt need of mechanical means of removing the rock from the apatite, in place of the slow and ineffective methods of hand cobbing, has been in a measure realized and a great impetus is likely to be given to the phosphate industry by the ingenuity of the inventors and the enterprise of the owners.

Mr. Fred Wilson's team of handsome blacks now awaits to drive to Mr. Wm. McIntosh's successfully opened mine in Templeton, with a range of further possibilities of visits to famous mines most tempting to the explorer and excursionist. One who visits this region need fear no limitation of opportunities for research and enjoyment. Rod and gun have their mission abundantly provided for, and as evidence of the treatment the wayfarer may expect, it may be mentioned that taking refuge from a shower in the little log house of Mr. Robert Corner, the party was made to partake of dinner, for which compensation was refused, and the money left upon the table was brought to the carriage with the earnest remonstrance, "God forbid we should take anything for giving a body a bit to eat."

Such is a phosphate trip up the Lievres River and such is the hospitality and simplicity of the people. Surely

nowhere can the lover of nature, the seeker for adventure and the inquirer into mining industries and resources find a better field for an outing.

The Early History of Copper Mining on Lake Superior.

E. B. Borron, M. E. Collingwood, Ont. *

It would appear from what are called Indian diggings that the existence of native copper on both shores of Lake Superior must have been known to some of the inhabitants of this continent in very remote times. The only localities where these diggings have been found on the north shore are, so far as I know, at Cape Mamainse and upon Isle Royal. Although the occurrence of native copper on both sides of Lake Superior was mentioned a century before in the narrations of the Jesuit missionaries, it was not till the year 1770 that we hear of any active mining operations by Europeans. We learn that some three years before that date one Alexander Henry, an Englishman, engaged in trading with Indians, had passed the winter on Michipicoten Island and reported the existence of lead at Mamainse and of the grey ore of copper at that and various other places. In the year following, 1768, Captain Carver hazarded the prediction that "in future times an advantageous trade in copper will spring up." So far, taking in both shores, the gallant captain was a prophet; but in view of the magnificent canal and locks since completed, how primitive were his notions as to the best way of accomplishing this? For he goes on to say, "The metal will be conveyed in canoes through the falls of Ste. Marie, and thence in larger vessels to the falls of Niagara, and after being carried by land across the portage will easily be transported to Quebec." In 1770 Henry formed a company, in which the Duke of Gloucester and other prominent Englishmen were partners, to work mines on Lake Superior. They had a shipyard, it is said, at Port aux Pines, about six miles above Ste. Marie, where they built a sloop of 40 tons. A party of miners were in the first instance sent to Ontonagon river on the south shore, where it would seem to have met with no success. The force was then transferred to the north shore, somewhere it is thought about Pointe-aux-Mines or Mica bay. Here they sank thirty feet in the solid rock, but the vein, which at the surface was four feet in breadth; had, it is said, contracted in the bottom of the shaft to four inches, and under these discouraging circumstances further mining operations were abandoned. In one narrative it is stated that the shaft caved in and killed some of the miners, and that this, together with the difficulty and expense of transporting supplies, led to the abandonment of the enterprise. From other sources we learn that the drift which the miners were driving in soft ground caved in, owing to them neglecting to timber it properly. It is unlikely that such an accident would occur to a shaft sunk in the solid rock and not more than thirty feet deep. This circumstance, taken in conjunction with the fact that many other veins presenting a good appearance at the surface, in that section of the country, have subsequently been found to fail and become worthless at a comparatively shallow depth, leads me to think that the first account is the true one. Henry remarks that it was partly in hopes of finding silver in sufficient abundance to make the speculation profitable that the works were commenced. To Dr. Douglas Houghton, State Geologist of Michigan, belongs the merit of being the first to explore, and in his report for 1841, to make known the leading features of the region on the south side of Lake Superior, and to give reliable and definite information with regard to the rich deposits of native copper. With the enterprise so strongly characteristic of our neighbours, no sooner had the Indian Title been extinguished (1843) than a vast number of applications were made for tracts of mineral land, and the work for both exploration and development was carried on with great vigor, and in some instances with remarkable success. From the year 1773 till 1845 no mining whatever was done, as far as I know, on either the north shore of Lake Superior or Lake Huron. About the latter date, however, the attention of Canadians having been roused by the richness of some of the veins discovered on the south shore, they began to form companies with the view of exploring for and working the mineral deposits on the north shore, which it was thought might prove as rich as those on the American side. Among others was the Montreal Mining Company. The first steps towards the organization of this enterprising company were taken, I believe, in 1845, for I find on reference to a few rough notes taken from the annual reports that Mr. Forrest Sheppard left Montreal with a small party on May 2nd, 1846, for Lake Superior to explore for and locate mineral land for that company. This was followed by another and larger party on the 8th of that month. The whole, when ultimately assembled on Lake Superior, numbered between eighty and ninety persons, and were under the charge of Mr. Sheppard,

who had been highly recommended as well qualified for the position. The coast from Sault Ste. Marie to Pigeon river, upwards of 500 miles in length, was surveyed and more or less carefully explored. That the company were very sanguine as to the importance of the results of this costly expedition, and the great value of the mineral tracts thus acquired by them is evident from the first annual report of the trustees, wherein the north shore is described as "a region abounding in mineral treasures requiring only the hand of the miner to convert it into a source of perhaps inexhaustible wealth." Mr. Sheppard selected eighteen tracts, or mining locations, as we call them. Each tract was, in terms of the Crown Lands regulations of that day, five miles in depth by two in width, and contained ten square miles of land. These, with one or two exceptions were all obtained from the Government. The price then charged was I believe, £150 Halifax currency paid down for each location, and 4s. or 80 cents an acre, payable by instalments. I think, however, that the company obtained their land for 20 cents an acre. In 1847 the company's operations were confined to a re-examination of the locations on Lake Superior and to testing the veins upon several of them, in addition to which the coast of Lake Huron was explored from Sault Ste. Marie to Lacloche, and several other mining locations applied for, which, however, were subsequently abandoned. The company was greatly disappointed with the results of both the re-examination and the work done on their Lake Superior locations. They had failed to realize the hopes raised by the explorations of the previous season, and the directors naturally, but somewhat hastily, as it appears to me, blamed Mr. Sheppard for his selection, and the men who were employed to test the veins on the locations, for their supposed incompetence.

In justice to Mr. Sheppard it is only right to mention that twenty-one years later the celebrated Silver Islet vein was found to be included within the limits of one of the locations selected by him, and for aught we know other veins quite as valuable may be found in other locations. It was in this year that rich copper veins were discovered on what were afterwards known as the Bruce Mines and Copper Bay locations. The Montreal company, by the advice of their manager, Captain Roberts, an experienced miner who had been brought out from the United Kingdom, purchased the Bruce Mines location. So strongly was Captain Roberts convinced of its value that he recommended the directors to pay as much as £100,000 sterling, if it could not be obtained for a smaller sum. The amount actually paid was, I believe, about £40,000 Halifax currency. The company had previous to this completed its organization and obtained a charter but after the purchase of this property the stock was raised from 40,000 to 60,000 shares of £5 currency each, and the whole energies and means of the company were thereafter concentrated on the Bruce mines. In the three following years, 1848-49-50, work at the mines, both underground and upon the surface, was prosecuted with great vigor. Dwelling houses sufficient to accommodate several hundred persons, with offices, stores, warehouses, wharves, etc., suitable for mining on a very extensive scale, were built; a powerful engine and ore dressing machinery put in place, and large copper-smelting and refining works erected. Shafts had been sunk, levels driven, and a large quantity of ground stoped, the ore or produce of which was for the most part lying at the surface at midsummer, 1850. A great sum of money had been spent and no returns as yet obtained in a tangible form or shape from the mine. The ore, estimated to contain 6½% copper, as it came from the mine, owing to the expense of transport, was not marketable until dressed or separated from a portion at least of the rock with which it was intermixed. In order to do this a powerful engine and suitable machinery were necessary. These had arrived at the mines from England, together with an engineering expert, in the fall of 1848. This man very imprudently built an engine house of rough or imperfectly hewn stone in the winter, and before spring most of the machinery was in place. The consequence was that as soon as the spring thaw set in this large and costly building fell down. This misfortune, and a severe visitation of cholera, in 1849, delayed the completion of the ore dressing machinery and the possibility of obtaining returns until the summer of 1850. The company had now arrived at what may be regarded as the most critical period of its existence. The stockholders had been led to believe that the veins were extraordinarily rich, and that there was sufficient rough ore already mined and at the surface to yield when cleaned some 5,000 tons of dressed ore, worth at least \$200,000 or \$250,000 net. The opinions, estimates and reports upon which these sanguine beliefs rested were, now that both the ore dressing machinery and smelting works had been completed, to be tested by practical results. In order that nothing might be wanting to ensure success, the president of the company, the late Hon. James Ferrier, went to England and brought out a mining captain, a copper refiner and three furnace men. He also selected a gentleman for manager so highly recommended that the board of directors made an agreement with him for five years. Not-

* Evidence before the Royal Commission of Ontario.

withstanding all these precautions the result of the following years operations were a sad disappointment to all concerned. The ore dressing machinery was found to be incapable of crushing and cleaning properly more than one-half the quantity of ore the engineers had said it would do. The ore on the surface was found to yield when dressed little more than half the quantity and value that it had been estimated at, and the smelting of the ore by the Welsh process had proved a complete failure. Under these circumstances the anger of the unfortunate stock holders would seem to have fallen on their officers, all of whom either resigned or were dismissed the following year, 1851. In 1852 I was myself appointed manager of the Bruce mines. The mining captains still continued to report that the stopes were producing from two to three and in some instances four tons of 15 per cent. copper ore per fathom. Careful comparison of the total quantity of ground stoped or otherwise excavated, with the number of tons of dressed or marketable ore actually obtained therefrom, convinced me that the veins had not upon an average yielded more than one and a half tons of 15 per cent. copper ore per fathom. Hitherto the miners had worked under what is known in Cornwall as the "tut-work" system. Under this system they are paid according to the quantity of ground cut, but have no interest whatever in the ore. The other system is that under which the miners are paid so much a ton of the dressed ore. In Cornwall it is called working on tribute, and the system under other names and with modifications is adopted in many mines elsewhere. The "tributer" is deeply concerned in the richness of the veins; and while it is his interest in common with his employer to avoid all waste of ore, it is not his interest unnecessarily to excavate or stop away the wall rock or barren and unproductive portions of the vein. This system I determined, if possible, to introduce.

The miners were accordingly offered prices which would have enabled them to have earned considerably higher wages than under the former or tut-work system, if the estimates and reports of the mining captains in reference to the productiveness of the various stopes or pitches had not been excessive. All except a few refused to take bargains on the terms offered, and many left the mine rather than do so, most of them asserting that the estimates in question were too sanguine, if not greatly exaggerated. Some twenty miners, however, consented to take contracts in the richer portions of the veins under a modified form of the tribute system, at prices based upon our own estimates. By thus reducing the mining expenditure within narrow and safe limits, and at the same time keeping the ore-dressing machinery fully employed cleaning up the poor ores and waste, of which there was a considerable quantity, especially in the form of skimmings, or skimmings thrown off in the process of jigging, it appeared to me quite feasible to make returns which would for several years at least exceed the expenditure. This policy I concluded to carry out with the approbation of the President, then Mr. Hugh Allan, hoping that in the meantime some improvement in the mine, increase in the price of copper or reduction in the cost of producing and transporting the ores to market, might enable us to render a favorable balance permanent. Expectations were so far realized that in 1853 the directors felt justified in declaring a small dividend, followed by a larger one in 1854. In this the board, as afterwards appeared, acted precipitately, being moved thereto rather by what was hoped for and expected than by what had been really accomplished. I was myself sanguine that the returns in these first years of my management would exceed the expenditure, and although I did not advise that step, my reports may unintentionally have led in some measure to its being taken. In 1853 and 1854 the price of copper was exceedingly high, and I was strongly urged by the president to increase the output of the mine to its utmost capacity. To do this we were obliged to resort to the tut-work system again, as a limited number of miners only were willing to work on tribute. The result was again most unsatisfactory, and a serious loss was sustained in 1854 and 1855. This loss was owing to the necessity we were under of working the poorer stopes, and to the very high wages we were obliged to pay both miners and laborers in consequence of the demand for men not only at the mines on the south shore of Lake Superior, but at Sault Ste. Marie, where the canal was at that time under construction. It was, however, greatly aggravated by the total loss of the company's steamer late in the fall of 1854, with very nearly all the materials and machinery required for mining and ore dressing operations during the winter—a loss which could not be fully replaced before the next summer. It may be proper to mention that in 1853 I began to fear that the veins were becoming poorer, and that if they fell off generally as much as they had done in several of the deeper shafts they would soon become unworkable. These opinions were represented to the president, and I urged him repeatedly, in the interest of the stockholders, to sell the mine if anything like a reasonable offer could be obtained for it. This at length he attempted to do, but the price asked was so high that no one would even look at it. It was perhaps in anticipation of being placed in a better position to dispose of the mines on good terms

that the president was led to advise the payment of a dividend in 1854.

In the summer of 1885 the tribute system was again adopted and the mining operations on a limited scale were thus carried on without much loss I think till about 1864 or 1865 when the whole location was sold to the West Canada Mining Company, who had for ten years rented the western portion of it. In 1870 the Montreal company sold the whole of their immense Lake Superior property, inclusive of Silver islet. This unlucky sale was, I believe, brought about partly in the fear that the silver ore, of the existence of which they were fully aware, was a superficial or surface show only and would not go down to any considerable depth, and partly in the belief that situated as the vein was below the water of Lake Superior it would be exceedingly difficult if not impossible to work it, and that at any rate a large sum would have to be raised and expended and might possibly be lost; in addition to which they were threatened with law suits in regard to their title. Still if the patience and the means of the company had not been exhausted by twenty years of unsuccessful effort at Bruce mines they would undoubtedly, I think, have retained and worked Silver islet and been, if the reports of the working of that mine are to be credited, amply compensated for their previous losses and disappointments. In view of the fact that its directorate has included many of the shrewdest and most upright and honorable merchants and professional men in the City of Montreal, and that its officers have been men of at least average intelligence and experience, results so disastrous to the stockholders and discouraging to others call for explanation. There are several reasons why, in my opinion, the Bruce mines failed to realize the sanguine expectations of the company. The veins on the surface were large and showy, containing more or less of the rich grey and purple ores of copper in addition to the common yellow ore. The gauge of the veins, throughout which the ore was distributed was a pure white quartz, and the whole doubtless presented, a very fine appearance. Captain Roberts on first seeing the location reported as follows: "This vast deposit of copper ore at the outcrop of the veins is incalculable and almost unparalleled. It exceeds anything I have seen or heard of in Europe." Whether from a failure in the richness or in the quantity of the ore, or in both, we find that Captain Roberts one year later had modified or changed his opinions. There is no doubt that the rich grey and horseflesh ores gave place to the poorer yellow ore at a very insignificant depth, and it is probable even that in this short time the veins in some of the stopes had become less productive. A very careful examination of the mine by the late Sir William Logan at this time (1848) went to show however that the veins were still so rich that on the assumption that these was no further falling off in their productiveness, and that all the copper could be obtained in a marketable condition, a large profit might in his opinion still be realized from the mines. But it was in these very assumptions that the chief obstacles to the realization of the profit lay. So intimately blended was the ore with the matrix of the veins, and so inconsiderable the difference of specific gravity, that by no ore dressing machinery or process of separation by water then known was it practicable to obtain in a marketable state anything like all the copper contained in the rough ore or vein stuff as brought from the mine. In attempting to dress the ore to yield 15 per cent. of copper or upwards, not less than two-fifths of it I believe was lost in the deads, or skimmings, and in the slimes. Again as regards the deterioration of the veins, there can be no question whatever that they became poorer and less productive in depth, and that at a relatively shallow depth, as compared with veins in other mining countries, they ran out or became so poor as to be no longer worth following. Very little work has really been done below the 35-fathom level, and the deepest shaft at the Bruce mines was only about 50 fathoms. Thus, without attributing to the managers and other officers of the company either incompetence or deliberate misrepresentation, we find in these two facts, namely: (1) the failure of the veins or lodes in depth, and (2) the impossibility of obtaining in a marketable form much more than three-fifths of the copper actually contained in the veins, sufficient explanation of the almost unbroken succession of over-sanguine reports and estimates on the one hand, and of disappointed hopes and expectations on the other. In 1853 Mr. Sampson Vivian, a miner of Cornwall, England, who had spent some years in the United States, obtained from the Montreal Mining Company, at a royalty of one-twentieth of the dressed ore, a fourteen years' lease of the eastern part of the Bruce mines location. Several veins had already been discovered, and some little mining done by the Montreal Company, but the ore produced being poorer than that got in the eastern part of the location they had not been worked for several years. It was doubtless under the impression that the Bruce mines had been so named in honor of the Scottish patriot, instead of the Earl of Elgin, at that time Governor General of Canada, that Captain Vivian called his mine the Wellington mine.

The ensuing year the lease was assigned to an English company which he had succeeded in forming. It assumed the name of the West Canada Mining Company, and the general management was entrusted to the well-known firm of John Taylor & Sons, of London. Had the company's operations been confined to the lodes or veins of the existence of which they were aware when they commenced, I am persuaded that they would soon have abandoned the enterprise. It was not very long after they had started, however, when a teamster, named George Clarke I think, in searching for strayed cattle accidentally stumbled on a vein previously unknown. A recent bush fire had burned off the moss and vegetable matter, and left the lode exposed at one or two points where it had previously been hidden from view. When uncovered or stripped, this vein and another with which it formed a junction some distance from where it was first discovered, proved not only to be much larger and richer than those the company were then working, but far better than those at the Bruce mines, which the Montreal Company had retained in their own hands. As the uncovering of the veins was proceeded with it became evident to the managers of the West Canada Mining Company that they would, if they kept their course, cross the western boundary. They accordingly very judiciously secured a lease of the adjoining Huron Copper-bay location. I can only say, generally, in regard to this enterprising company's operations, that they were, so far as I had an opportunity of judging, carried on in a miner-like manner; such engines, machinery and ore-dressing apparatus as the large experience of the London managers suggested as being calculated to ensure successful results, were sent out and erected at the mines. So great were the difficulties, and so heavy was the cost of starting and opening up the mines, that notwithstanding the richness of the veins no dividends were, I believe, declared for the first six or seven years. In the next seven years, however, under the energetic and judicious management of their local agents, Mr. James Bennett and Captain William Plummer, several dividends amounting in the aggregate to a large sum were paid to the shareholders. In view of the early termination of their lease of the Wellington mine the company in 1864 or 1865 purchased the whole location, including the Bruce mines, from the Montreal Mining Company. The same difficulties which had been found insurmountable by the Montreal Mining Company and its managers, and under which they had been obliged to succumb, together with lower prices for copper, began to tell with increasing severity on the West Canada Company; and in 1867 or 1868 it would appear that the results had not been satisfactory, for at that period Mr. John Taylor, jr., of London, was sent out to examine and report on the property. He spent six weeks at the mines and his report, which was rendered on the 12th of September, 1868, is remarkable not merely for its ability, but for its general fairness. Mr. Taylor clearly apprehended the chief obstacles to the profitable working of the mines when he says:—"It is evident that the three main points you have now to contend with are (1) the very heavy cost of dressing; (2) the great loss of copper under the present system of washing; and (3) the high rate of freight from the mines home to England." He made two suggestions calculated in his own opinion to reduce the expenses and economize the waste of copper. These were, (1) to smelt the ore on the spot; (2) to reduce the copper by what is commonly known as the salt process. He himself favored smelting, but as in both the copper would be obtained in a metallic state, he estimated the saving in the item of freight alone would not be less than £7,000 or £8,000 sterling per annum. In addition, however, to the three points specially mentioned, another circumstance only slightly alluded to in Mr. Taylor's report must have begun before this time to exercise an adverse influence on the returns from the mine. No one who saw the size or richness of the veins at or near the surface in 1855-56 could fail to perceive, on perusing that part of the report which describes their appearance in the bottom of the various shafts and stopes in 1868, that there had been a great falling off both in the size and the richness of the veins at the depth of 40 or 50 fathoms. Mining operations continued to be carried on till 1876, when in consequence I presume of the continued unsatisfactory results, work was suspended and has not since been resumed. During the mining excitement of 1846-47 a number of other locations were taken up on the north shore of Lake Huron. Among them there was one near the mouth of the Whitefish river, on which at least one shaft had been sunk to the depth of 10 or 15 fathoms, so far as I could judge from the quantity of stuff produced, for I did not see it when open. It was known as the Wallace mine, and owned by the Upper Canada Mining Company. The vein contained copper pyrites and ore of nickel, but not in sufficient quantity apparently to justify further expenditure. I am inclined to think this company had a location on Michipicoten Island, where considerable work was done on a vein of native copper. Some mining was done at the Emerald mine on the Rankin location, near Sault Ste. Marie. The ore was the yellow ore of copper, and in such quantity that had

it been solid, and not so dispersed throughout the gangue of the vein, it would probably have received a more thorough trial. Several locations were also taken up by the late Mr. Killaly and others near Echo lake, on which there were good sized veins.

On two of these shafts were sunk, but which I think did not exceed five fathoms. It was the yellow ore in a gangue of white quartz, but so far as I can recollect it would not yield more than 2 per cent. of copper. Some work was also done at the Begley mine on the north side of Batchawana Bay, where the yellow ore of copper was found in good quantity but of low grade. At none of these mines, so far as known to me, was any copper dressed and sent to market. The Quebec mining company was a bona fide Canadian company organised about the same time as the Montreal Mining Company. The locations of this company were all situated on the north shore of Lake Superior, and on Michipicoten Island, at Point aux Mines or Mica Bay. Misled by surface appearances, and to say the least by the imprudent advice of their manager, they appear to have commenced operations with great spirit, or rather recklessness; a large number of substantial and comfortable dwellings for officers and men, and other buildings such as storehouses, offices, blacksmiths' and carpenters' shops were erected; a good overshot water wheel and ore dressing machinery were also put up; and to complete all one or two copper smelting furnaces were built. From the large force employed at the mine I should think that a good deal had been done under ground as well as on the surface, in the two or three years during which it was worked. In the fall of 1849 the mine was taken possession of for a short time by the Indians, who were dissatisfied because a treaty had not been made with them for the surrender of their rights; but a treaty was concluded in the following year, and no further trouble was occasioned by them. About this time the company tried to sell the mine in England, and an expert was sent out to examine it. He reported, I have been told, unfavorably. At all events the mine was not sold, and in 1850 or 1851 operations were suspended and have not since been resumed. The Quebec company must have expended more than \$100,000, and I have heard that only enough ore was got out to make three or four tons of copper. It is probable that there might be more or less poor ore that would not pay the expense of dressing and smelting. Be this as it may, for I only speak from hearsay in regard to operations prior to 1852, the returns obtained from the mine were unquestionably very small. Some work was done, I believe, on Michipicoten Island, but the result was not encouraging and operations were abandoned there also. About the same time a company called the British North American, I think, did some mining at Princess Bay.

The object of their search was also copper, but I was told by some of the miners who had worked there that it appeared to them more promising for silver than copper. It was also abandoned about the year 1850. I omitted to mention that in 1856-57 the Montreal Mining Co., on my recommendation, made a cautious trial of their location at Point Mamainse, on the north shore of Lake Superior. The veins so far as discovered were neither large, regular, nor well defined, but the display of ore on the surface was tempting, consisting as it did of native copper, grey and yellow ores of copper and galena or lead ore. In this last there was some twelve ounces or more of silver to the ton, and native silver was found associated with the native copper. As little as possible was spent on the surface, pending the result of the contemplated mining operations. Considerable prospecting was done and five shafts were sunk to depths varying from 14 to 60 feet on the most promising mines. From one shaft, which was sunk at a point where there had been an Indian digging, about 1,400 pounds of native copper was obtained. The largest piece weighed nearly 600 pounds, the biggest mass that had been got on the north shore up to that time, if not since. The vein, from the first small and without regular walls, ran out almost entirely at the depth of 10 fathoms, and as it was costing nearly \$200 a fathom to sink the shaft it was stopped at that point. Three other shafts were sunk on different veins on the same trap range as that which produced the native copper, but only grey and yellow copper ores were got, and these not in sufficient quantities to pay, even had there been ore dressing machinery on the spot. The fifth shaft was on a native copper vein on another range of trap some 150 fathoms to the east of that last mentioned—a strong bed of conglomerate being interposed between them. It produced at first some nice pieces of native copper, but at 25 feet in depth the vein was barren of metal, although still ten inches in width and carrying good mineral soils and spars. The vein of silver-lead was too small to warrant the expense of sinking more than a few feet on it. In view of the company's financial condition, and of the fact that a large sum would be necessary to thoroughly test the mine without assured profitable results, operations were suspended in 1857, the amount thus expended being about \$5,000. I am under the impression that the Silver Islet Company have, since their acquisition of the Montreal Mining Co.'s Lake

Superior property, done some work on this location, but with what results I am unable to say. Two English companies have engaged in copper mining on the north shore at a comparatively recent date. One of these properties is situated at Cape Mamainse, upon a location immediately adjoining that I have just described. The other is on the Island of Michipicoten. A large sum of money has been, I believe spent on both mines, but especially upon that at Mamainse. The shipments of copper have been relatively insignificant. That the results have been unsatisfactory, to the shareholders at least, may be inferred from the circumstance that at both these mines operations have now been suspended.

Of the copper mines at Sudbury I am unable to say anything, as I have not seen or examined them. This history of copper mining on Lakes Superior and Huron really includes all or nearly all that has been done in the Province. At least I am not aware of any other part of Ontario where copper mining has been carried on to any extent worth mentioning. That these enterprises have, almost without exception, resulted disastrously cannot be denied, however conflicting may be the reasons given by different parties before the Commission. Nor can it be denied that it would have been very much better for the stockholders in the various mines if the three million dollars worth of copper obtained therefrom had still remained buried in the bowels of the earth, and the four or five millions worth of gold, or its equivalent, expended in searching for and mining this copper, had remained in their pockets. Other parties may have benefited, but the men, for the most part Canadians, who furnished the capital clearly have not. But should anyone infer from the uniformly disastrous results of these premature mining operations that the mineral resources of Ontario, so far as copper is concerned, are unimportant if not worthless, I must beg decidedly to differ from him. In the district of Algoma, from the mouth of French river on Lake Huron to Pigeon river on Lake Superior, upwards of 400 miles in a straight line and nearly double that distance following the sinuosities of the coast, and from thence northward to the height of land, there is, I believe, no considerable area in which copper-bearing rocks do not occur. All along the coast, wherever these rocks are exposed to view, strings or veins carrying more or less copper may be found at short intervals. East of Goulais Bay the copper, so far as my experience enables me to speak, is always found in the form of sulphurets, chiefly copper pyrites, commonly known as the yellow ore. West of Goulais Bay we find the same ores, together with more or less native copper. On almost every considerable lake in the interior indications of copper may be seen if the copper-bearing rocks on the shores be examined carefully, and not infrequently good sized veins are met with, which, under more favorable conditions, would be considered if not rich at any rate worthy of trial. Supposing this belt in which copper-bearing rocks at least predominate to be no more than 50 miles wide, we have an area of 20,000 square miles of what may be termed copper-bearing country in the district of Algoma alone. It is true that many of the strings or veins are small and irregular, and contain so little copper as to be unworthy of attention, that many in which the appearance at the surface is promising fail at a trifling depth, and that even those veins which have been the largest, most regular and the richest in copper at and near the outcrop, have fallen off greatly both in size and regularity, as well as in the quantity and quality of the ore, at a depth of from two to three hundred feet. Nevertheless, we are confronted by the fact that a small strip of this copper-bearing country, two miles in length by about half a mile in breadth, or one square mile in all, has actually produced between 40,000 and 50,000 tons of dressed copper ore, worth in the English markets two and a-half and three millions dollars. Nor are the mines on this single section of land, though of course poorer, by any means as yet nearly exhausted. It is not pretended that deposits such as those at the Bruce mines, the Wellington mines and at Sudbury are to be found everywhere in this mineral belt, nor, in view of the extent and depth of the loose material under which the veins are in most parts entirely hidden, can it be expected that such discoveries will be of very frequent occurrence; but it is safe to assert that in all human probability a great number of such veins or deposits of copper ore do exist in this belt, quite as rich as, if not richer than, any of those already discovered, and that from time to time, as the country is settled, many of them will be found, accidentally or otherwise. I hold therefore that this field of the mineral resources of Ontario is immensely important and valuable; where so much copper in quantity and value has been obtained from such a limited area, how much may not be reasonably expected from the whole of this copper-bearing belt. It may be said, and with some show of reason, that, granting many millions of tons of copper ore may be contained in the rocks of this mineral belt, of what possible importance or value can it be to the province if it is so distributed, and the difficulty and expense of mining it be so great, that when obtained the cost of getting the copper shall be found to have exceeded its value. Now, although in a sense this may and doubt-

less does hold good, in regard to the present value of the copper in this belt, the prospective value to the province may nevertheless be very great.

Were we compelled to mine, dress and send to market this copper under the unfavorable conditions which have hitherto prevailed in this country, experience has demonstrated that it could only be done at a loss. But under the more favorable conditions that will surely obtain in the future it is morally certain that many of these deposits of copper may and will be worked most profitably, and thus prove a source of incalculable wealth to the province. In order to make this clear, let us suppose the Bruce and Wellington mines to have been situated in England, and we shall see how much more favorable the conditions would have been. The wages of the miners and the laborers would have been less than one-half, and the cost of mining would have been reduced in like proportion. The dressing of ores, which in England is done almost entirely by young women and boys, would have not been more than one-third of the cost of that operation in Canada. The expense of transportation to market would not, I consider, have been more than one-tenth of the sum paid for the freight of the ore from Bruce mines to Liverpool or Swansea; in addition to all which it would not have been necessary to bring up the ores by dressing to more than 8 or 9 per cent. of copper instead of from 15 to 20 per cent., thus saving not only expenses but a very large quantity of copper unavoidably lost in the process. Then again, machinery and all kinds of stores and materials, timber excepted, would have been very much cheaper in England. From all these circumstances I am convinced that had the vein at the Bruce mines and the Huron Copper-Bay locations or others of the like character and richness been situated in Cornwall, or almost any other part of Europe they would unquestionably have yielded the fortunate owners very large profits. Now the point I wish to make is this: If our Canadian copper mines be such that if situated in Europe they would have realised very large profits and been considered very valuable, it necessarily follows that to soon as those favorable conditions arrive in Ontario, then at all events, if not before, will copper-mining in this province become profitable, and the vast deposits of that metal in the copper-bearing belt north and west of the great lakes become in the fullest sense of the term valuable. The conditions most necessary to profitable mining, whether in respect of labor, of materials, or of transportation, are being surely, if not rapidly, evolved in the district in which the mines are situated. No one who has noted the growth of the district of Algoma in population and otherwise during the last 30 or 40 years can fail to perceive that fact. But on broader grounds I hold it to be absolutely certain that sooner or later all the disabilities under which in the past copper mining has labored will be removed, and that this country will stand in just as good a position as England herself in regard to the economical and profitable working of her mines. In addition to cheaper labor than was obtainable on the first opening up of the country, much may be expected from the employment of labor-saving machinery in our mines. The use of rock drills, worked by steam or water power, the substitution of dynamite and other more powerful explosives for gunpowder, the employment of galvanic batteries or electricity to discharge simultaneously a number of blasts so placed as to produce the greatest possible effect, are all calculated to greatly diminish the cost of mining, even if wages should remain the same. It is possible also that improvements may be made in the smelting or reduction of copper from its ores. In concluding my remarks as to our copper deposits, I would like to add a word of warning to all engaged or about to engage in mining enterprises, especially in districts where the character of the veins at a considerable depth has not been proved. Not a dollar beyond what is absolutely unavoidable should be expended on the surface, however promising the appearance of the outcrop may be, until one or more shafts have been sunk to a depth of at least fifty fathoms and levels driven each way. This is especially necessary where former experience goes to show that the veins frequently become smaller and poorer, if not altogether barren, at a very trifling depth. Surface expenditure is utterly wasted and becomes a dead loss when the mine itself fails. The fewer failures and the greater number of dividend-paying mines, the more attractive will be the industry to capitalists.

The Canadian Iron Bounty.—The Dominion Parliament has agreed to a proposal, submitted by the Government, for an increase in the bounties that are at present paid upon pig iron manufactured in Canada, with a view to further encouraging the industry. In 1883 a bounty of 1 dol. 50c. per ton (of 2,000 lb.) was granted for three years, and 1 dol. per ton for another three years afterwards. The bounty of 1 dol. 50c. was, however, renewed in 1886, the 1 dol. per ton being made to apply from 1889 to 1892. Under the new arrangement the present bounty will continue until 1892, but from that year it will be increased to 2 dols. per ton for a period of years.

Note on the Friction of Mine-Car Wheels.*

By R. Van A. Norris, Wilkesbarre, Pa.

The following tests were made, during 1889, for the Susquehanna Coal Company, to determine the relative efficiency of several styles of mine-car wheels in use at their collieries at Nanticoke, Pa.

The wheels experimented upon may be divided into two classes: The "old style" (Figs. 1 and 2), which are oiled at every trip; and the "new style" (Figs. 3, 4 and 5), which require oiling about once in two to four months.

Fig. 1 shows a section of a plain cast wheel, with patent annular oil chamber. This is held in position on the axle by a square, split cotter-pin. Fig. 2 is a similar wheel, with a patent cast bushing, which is readily replaced when worn. The lubrication is effected by a simple oil-hole, but the oil is delivered a little inside of the gauge-line of the wheel, where it is most needed. Figs. 3, 4 and 5 are sections of a "new style" patented, self-oiling wheel. In this, the outer end is cast closed, and the wheel is fastened to the axle by a spring cotter-pin, passed through one of the plugged holes. Dirt is prevented from entering the open end by a cap, with faced end and packing-ring, fitting over the end of the

hub. The lubricant is introduced into the oil-chamber through one of the plugged holes in the hub.

When the wheel is in motion, the lubricant is thrown by centrifugal force away from the axle, enters the two ports shown, and is carried through spiral channels into contact with the axle, the surplus oil being carried back to the oil chamber again. The lubrication appears to be effected by oil adhering to, and being swept back and forth along the axle, in the open zig-zag slit, when passing through the ends of the oil channels away from the oil-chamber, where the section and height of the channel are smallest, the back of the oil-channel being conical with the largest end out, and the radial height of the channel from the axle decreasing as it recedes from the oil-chamber.

All the wheels are of the loose outside type, 16 inches in diameter, mounted on 2½-inch steel axles, with journals 5¼ inches long. The axles pass loosely through solid cast boxes, bolted to the bottom sills of the cars, and are not expected to revolve.

Tests were made on the starting and running friction of each style of wheel, under the conditions of empty and loaded cars, level and grade track, curves and tangents. The instruments used were a Pennsylvania Railroad spring dynamometer, graduated to 3000 pounds, with a sliding recorder, a hydraulic gauge (not recording) reading to

10,000 pounds, graduated to 25 pounds, and a spring balance, capacity 300 pounds, graduated to 3 pounds. All these were tested and found correct previous to the experiments.

Most of the observations on single cars were made with the 300-pound balance. The two types of "old style" wheels were found to give results so nearly alike that they have been classed together in the table. Each car was carefully oiled before testing, and several of each type were used, the results being averages from the number of trials shown in the table.

In the experiments upon slow start and motion, the cars were started very slowly by a block and tackle, and the reading was taken at the moment of starting. They were then kept just moving along the track for a considerable distance, and the average tractive force was noted—the whole constituting one experiment.

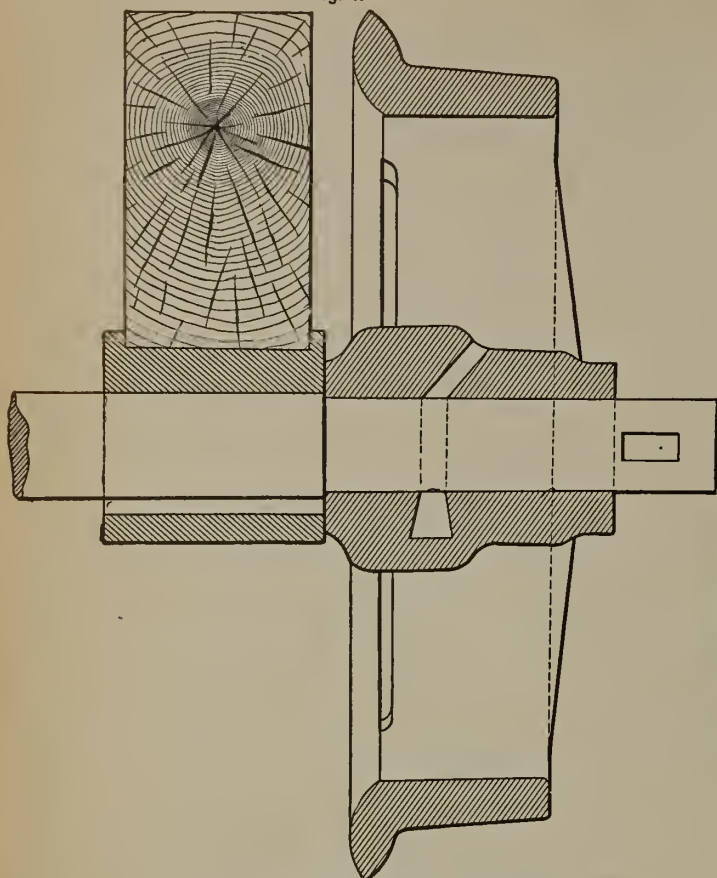
The track selected for these experiments was a perfectly straight and level piece of 42 inches gauge, about 200 feet long, in rather better condition than the average mine-track. The cars were 41¾ inches gauge, 3½ feet wheel base, 10 feet long, capacity about 85 cubic feet, with 6-inch topping.

To ascertain the tractive force required at higher speeds, trips of one, four and twenty cars, both empty and loaded, were attached to a mine-locomotive and run about a mile

Summary of Friction-Tests on Susquehanna Coal Co.'s Mine-Cars, April, 1889.

DIMENSIONS OF WHEELS. 16 in., diameter of tread. 2½ in., diameter of axle. 5¼ in., length of journal.	OLD STYLE WHEELS.												Number of Tests.	NEW STYLE WHEELS.														
	Empty.						Loaded.							Empty.						Loaded.								
	Weight of car.	Tractive force per car.	Tractive force due to gravity.	Trac. for. p'r car due to friction.	Trac. for. p'r ton due to friction.	Percentage of weight.	Weight of car.	Tractive force per car.	Tractive force due to gravity.	Trac. for. p'r car due to friction.	Trac. for. p'r ton due to friction.	Percentage of weight.	Weight of car.	Tractive force per car.	Tractive force due to gravity.	Trac. for. p'r car due to friction.	Trac. for. p'r ton due to friction.	Percentage of weight.	Weight of car.	Tractive force per car.	Tractive force due to gravity.	Trac. for. p'r car due to friction.	Trac. for. p'r ton due to friction.	Percentage of weight.				
LEVEL.																												
Average slow start.....	2240	100	....	100	100	4.46	8500	325	....	325	85	3.80	16	12	6	20	2415	66½	....	66½	62	2.78	9125	200	....	200	49	2.20
" slow start.....	2140	83	....	83	86½	3.88	7885	357	....	357	101½	4.53	63	53	82	48	2415	62	....	62	55½	2.48	8160	193	....	193	53	2.36
" motion 50 ft. pr. min.	2140	54	....	54	56½	2.52	7885	205	....	205	58½	2.60	54	60	81	72	2415	40	....	40	37½	1.66	8160	133	....	133	36½	1.63
" " 1000 ft. per minute, 1 car.....	2140	62	....	62	64½	2.89	7885	262	....	262	74½	3.32	17	74	6	39	2415	36½	....	36½	33½	1.48	8160	158	....	158	43½	1.93
" motion 1000 ft. per minute, 4 car.....	2240	62½	....	62½	62½	2.80							3	...	6	...	2415	37½	....	37½	34½	1.56						
" motion 1000 ft. per minute, 20 car....	2240	47	....	47	47	2.20	9000	117	....	117	29	1.30	6	18														
" starting jerk 20 cars.	2240	96	....	96	96	4.29	9000	175	....	175	44	1.95	3	7														
" starting jerk 2 cars rope-haul.....	2240	630	....	630	630	28.12							10															
-GRADE.																												
" slow start 12°.....	2140	550	445	105	110	4.90	7885	1950	1639	311	88½	3.94	2	2	2	2	2415	600	502	98	90½	4.06	8160	2000	1696	304	83½	3.73
" motion 50 ft. per min., 15°.....	2140	510	445	65	68	3.18	7885	1800	1639	161	45½	2.00	10	16	6	12	2415	540	502	38	35½	1.56	8160	1825	1696	129	35½	1.58
" motion 1000 ft. per min., 1¼°, 1 car..	2140	125	65	60	62½	2.80							10		6	6	2415	100	73	27	25	1.12	8160	400	249	151	41½	1.85
" motion 1000 ft. per min., 1½°, 1 car.							7885	425	205	220	62½	2.79		12		16							8160	350	212	138	37½	1.69
" motion 200 ft. per min., rope-haul, 2°.	2240	140	78	62	62	2.80							15															
" motion 200 ft. per min., rope-haul, 2°30'	2240	183	98	85	85	3.80							15															
" motion 200 ft. per min., rope-haul, 5°10'	2240	315	202	113	113	5.00							15															
" motion 200 ft. per min., rope-haul, 6°10'	2240	353	240	113	113	5.00							15															
CURVE.																												
" slow start, 85 ft. radius.....	2240	125	....	125	125	5.58	8500	400	....	400	106	4.70	10	10		8							9125	275	....	275	67	3.00
" slow start, 11 ft. radius 1½° grade..							8700	819	227	592	152	6.80		8		7							9125	564	239	325	80	3.60
" 20 cars 1000 ft. per min., 350 ft. radius.	2240	62	....	62	62	2.80	9000	143	....	143	36	1.60	5	7														
" 20 cars 1000 ft. per min., 450 ft. radius.	2240	50	....	50	50	2.23	9000	126	....	126	32	1.40	5	7														
" 4 cars 1000 ft. per min., 350 ft. radius.	2240	100	....	100	100	4.46							2		2		2415	75	....	75	70	3.10						
Total number of tests,												276	286	197	230	Equals 989 tests total.												

Fig. 1.



Hamlin Wheel, with Annular Oil-Chamber.

Fig. 4.

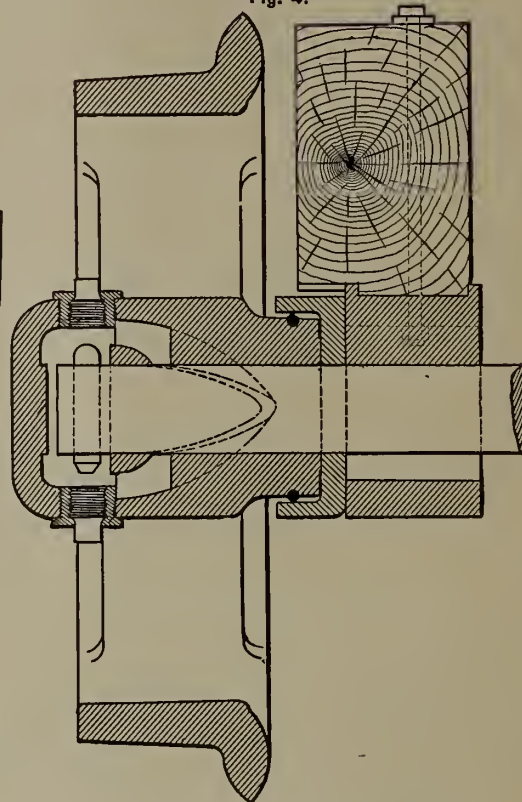
J. H. Bowden's Patent Self-Oiling Wheel.
Section through Oil-Ports.

Fig. 5.

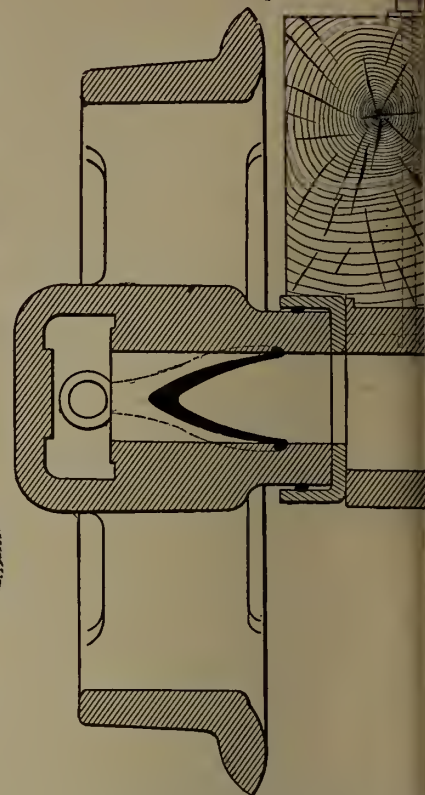
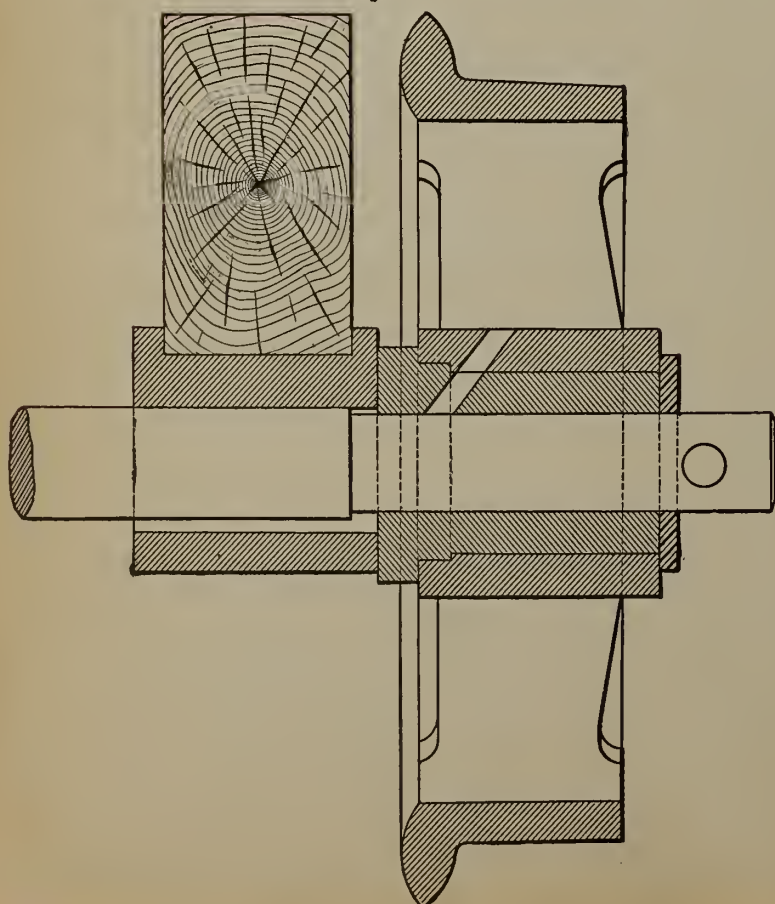
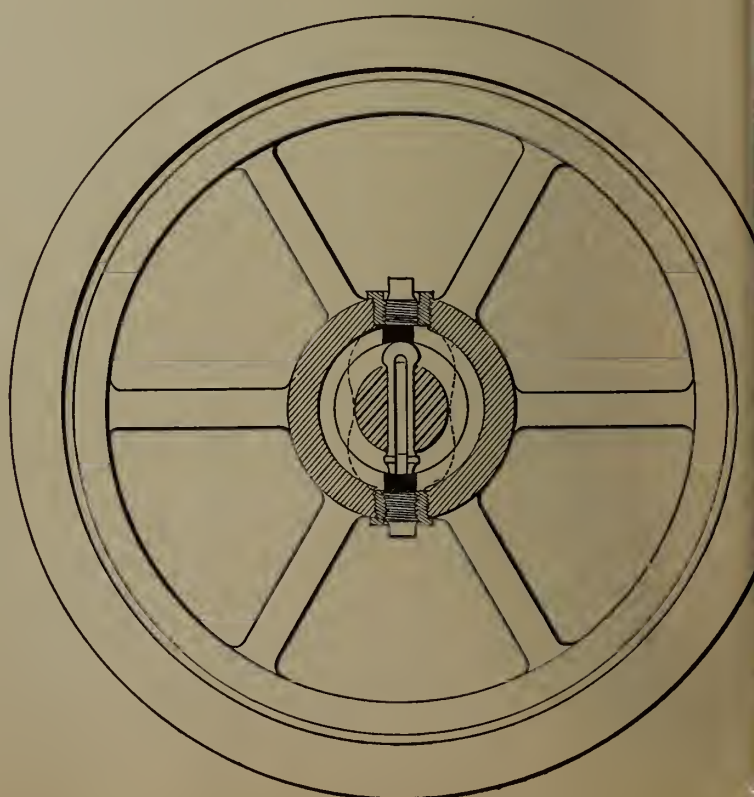
J. H. Bowden's Patent Self-Oiling Wheel
Section showing Oil-Grooves.

Fig. 2.



J. M. Norris's Wheel, with Patent Removable Bushing.

Fig. 3.

J. H. Bowden's Patent Self-Oiling Wheel.
Section through Hub.

for each test, the resistance at various points on the track, where its curve and grade were known, being noted, and care being taken to run at a constant speed. Unfortunately, only four of the "new style" cars were available on the tracks where these trials were made.

The remarkably low results for the twenty-car trips are attributed to variations in the condition of the track, and the fact that the whole train was seldom pulling directly on the locomotive, the cars moving by jerks, so that correct observations were impracticable. The hydraulic gauge was used for these twenty-car tests, and the needle showed vibrations from one to four tons and back. The mean was taken as nearly as possible. The gauge was rather too quickly sensitive for the work, and the Pennsylvania Railroad dynamometer was not strong enough to stand the starting jerks and the strain of accelerating speed.

The tests marked "rope-haul" were made on an empty-car haulage-system, about 500 feet long, with overhead endless rope running continuously at a speed of 180 feet per minute, the cars being attached to the moving rope by a chain, a ring at the end of which was slipped over a pin on the side of the car. The increase of friction on the heavier grades was due to the rope pulling at a greater angle across the car. Correction was not made for this angularity at the time, and the rope has since been re-arranged, so that the correction cannot now be made.

There were not enough curve-experiments to permit the deduction of any general formula for the resistance of these cars on curves.

The experiments on grade agree fairly well with those on a level, the rather higher values obtained being probably due more to the greater effort required in moving them and the consequent jerkiness of the motion than to any real increase in resistance. As the experiments on all styles of wheels were made in an exactly similar manner, the comparative value of the results is believed to be nearly correct, the probable error in each set of experiments, as computed by the method of least squares, varying from about 4 per cent. for slow start and motion to 12 per cent. for the rapid motion and twenty-car trips.

The general results, showing an economy in friction of nearly 40 per cent., led to the adoption of the "new style" wheels by the company. These results, obtained as carefully and accurately as the circumstances permitted, are now offered as showing the approximate frictional resistance of such wheels under the ordinary working conditions.

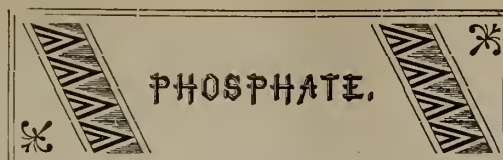
Comparison of Running Friction of Cars with Old and New Style Wheels on Straight Road, Level and Grade, under Similar Conditions. Average of 807 Tests.

	PERCENTAGE OF WEIGHT.			COMPARISON OF FRICTION.		
	Old style	New style.	Difference.	Old style per cent.	New style per cent.	Difference per cent.
Speed, 50 ft. per min...	2.57	1.61	0.96	100	62 $\frac{6}{10}$	37 $\frac{4}{10}$
" 1000 " "	2.92	1.68	1.28	100	57 $\frac{5}{10}$	42 $\frac{5}{10}$

*Transactions of the American Institute of Mining Engineers Washington meeting, February, 1890.

A Miner's Miraculous Escape.—A remarkable fall of a miner down 100 metres of a shaft (say 333 feet) without being killed, is recorded by M. Remneaux in the *Bulletin de l'Industrie Minérale*. Working with his brother in a gallery which issued on the shaft, he forgot the direction in which he was pushing a truck; so it went over, and he after it, falling into some mud with about three feet of water. He seems neither to have struck any of the wood debris nor the sides of the shaft, and he showed no contusions when he was helped out by his brother after about ten minutes. He could not, however, recall any of his impressions during the fall. The velocity on reaching the bottom would be about 140 feet, and time of fall 4.12 seconds, but it is thought he must have taken longer. It appears strange that he should have escaped simple suffocation and loss of consciousness during a time sufficient for the water to have drowned him.

Coal Production of the United Kingdom, 1889.—The official returns of the number of miners, the production of coal and the cost of life in that production, in the United Kingdom have been made known. Last year 176,916,724 tons were produced, some 6,000,000 tons more than in the preceding year. It is gratifying to notice the diminution in the loss of life—the general average being one life for every 178,227 tons.



Ocean Shipments.

The following are the official returns of shipments, per ocean freights, from the Port of Montreal to date:—

Date.	Name of Ship.	Destination.	Shippers.	Quantity.
May 10..	SS Vedra	London ..	Lomer, Rohr & Co	120
" 14..	Cremon	Hamburg.	Millar & Co	215
" 15..	Dominion	Liverpool.	Lomer, Rohr & Co	250
" 17..	Michigan	do	Millar & Co	200
" 23..	Heathfield	London ..	Lomer, Rohr & Co	300
" 27..	Amarnythia	Glasgow ..	do (bags)	100
" 28..	Toronto	Liverpool.	do	200
" 28..	Ashburne	Glasgow ..	do	210
" 29..	Bonnington	London ..	do	185
" 29..	do	do	Millar & Co	60
" 31..	Oxenholme	Liverpool.	Wilson & Green...	348
" 31..	Osmanlie	do	Lomer, Rohr & Co	150
June 2..	Sfs. of Magellan ..	do	Wilson & Green...	475
" 3..	Alcides	Glasgow ..	Lomer, Rohr & Co	200
" 4..	Sarnia	Liverpool.	do	100
" 6..	Maritana	London ..	do	150
" 7..	Kehrweider	Hamburg.	Millar & Co	300
" 7..	City of Lincoln ..	Liverpool.	do	700
" 11..	Lamington	London ..	Lomer, Rohr & Co	225
" 19..	Tynedale	London ..	do	225
"	Oregon	Liverpool.	do	200
"	Dominion	Liverpool.	do	200
Total tons				5,013
" bags				100

SHIPPERS' RECAPITULATION.

	Tons.	Bags.
Lomer, Rohr & Co.....	2,715	100
Wilson & Green.....	1,475	
Millar & Co.....	823	
Totals.....	5,013	100

RECAPITULATION OF EXPORTS.

	Tons.	Bags.
To London	1,265	
Hamburg	515	
Liverpool	2,823	
Glasgow	410	100
Totals.....	5,013	100

Templeton District.

The Blackburn mines, under the management of Messrs. Lomer, Rohr & Co., are being worked with much vigor, and an average output of 500 tons per month is being made; 100 men are employed. Five pits are under operation. As a great deal of development work has been done on the property, it is hoped to materially increase this output at an early date. Twenty-five teams are kept steadily at work hauling ore from the mine.

At the property of the McLaurin Phosphate Mining Company work is going on steadily on four different pits; a very large deposit on Lot 8 in the 17th is also being developed. Arrangements are being made to haul the ore to a shipping point immediately. The company expects to place at least 1,500 tons on the market this year.

Lievres District.

We are informed that Mr. Fred Wilson, Buckingham, has transferred his interest in his phosphate Lot adjoining the Ross Mountain to the Hon. J. C. Abbott and Hon. C. C. Colby, the consideration being \$8,000 cash.

Messrs. Lomer, Rohr & Co. have a gang at work picking over the dumps at the Emerald, and although the quality of ore thus obtained is necessarily of low grade, we understand that this enterprising firm are making a good thing out of their venture. Mr. S. P. Franchot who is now, we believe, the sole owner of these the oldest worked mines in the district, has a largely increased force at work underground, and from the quantities of ore being raised we should judge that he is again in bonanza.

Mr. J. B. Smith, M.E., manager of the Squaw Hill and Aetna mines has a force of some sixty men at work. The old "Grant" pit has been cleaned out and a number of promising pits uncovered. Mr. Smith is arranging for the construction of a tramway and the erection of a compressor and other mining plant. About 500 tons of excellent quality are ready for shipment.

At the Little Rapids mines, where operations have been mainly on the nature of development, and only a small force is employed, some good quality of ore has been raised, and about 300 tons are now ready for shipment.

Immediately adjacent to the Little Rapids are the operations of the Dominion Phosphate Company (of London) under direction of Mr. Gibbs. This enterprising company has erected suitable buildings and equipped the mines with an excellent working plant.

About 130 men are employed at the pits of the Phosphate of Lime Co. at High Rock under Mr. Walter Pickford. The yield to date has, we believe, been somewhat in excess of the figures reported during the same period last year. The extensive additions to the plant, including 12-drill Ingersoll Compressor, boilers and hoisting gear, will reach the mine by the end of the month, and when in working order will greatly increase the productiveness of these well equipped mines. By the way we regret very much to learn that Mr. P. C. Smith the genial mine manager at High Rock is under the weather again. For some time Mr. Smith's health has been anything but good, and he is now reluctantly compelled to seek a much needed rest and change. We are sure we join with all our phosphate readers in wishing Mr. Smith a speedy recovery and return to the mine, where his services are invaluable.

As stated in our last issue, the operations at the North Star are comparatively inactive owing to negotiations pending the transfer of the mines. The output, consequently, is not as large as last season, but Capt. Williams hopes to fill all existing contracts by the end of the shipping season.

Mr. S. P. Franchot has put up a large hoist and boiler, new Ingersoll drills, steam pumps and other gear at Central Lake. A tramline 2½ miles will also be built, but until this is completed the shipments from this mine must be merely nominal as hauling can only be done during the winter months.

The Messrs. Poupore, contractors on the new Locks at Little Rapids, are now making rapid progress with the construction of this important undertaking.

The grinding mills at Bassin-du-Lievres are running night and day turning out low grade stuff for the U.S. market.

Perth District.

The Anglo-Canadian Phosphate Co. is vigorously prosecuting day work at the Otty Lake mines. These pits have been put into operation and more will be opened. In six weeks, 110 tons of high grade phosphate, and 12 tons of seconds, were mined with an average force of less than twenty men. Thirty men are now at work and the number will be increased as fast as pits can be prepared. This property has been worked a good deal by contract and has over three hundred productive openings exposed. It was thought that most of the surface shows had been found, but recent efforts have discovered a number of new seams. Capt. Adams reports that his experience of contract mining is unfavorable. The men have every inducement to produce low quality and generally yield to the temptation, while their manner of working the pits is slovenly and injurious to the property. Henceforth the system of day's labor will be followed, for, though the output may cost more, the higher quality secures a better financial result.

Kingston District.

Summer hauling from the pits of the Foxton Mining Company at Sydenham has begun, and quite a number of teams are steadily employed in this work. Pit No. 1 has reached a depth of 190 feet, and the quality of the ore is found to continue first-class. Several new deposits are also being developed on the property.

Active operations have been begun on the pits of the Kingston Phosphate Mining Co. and the steam hoist and steam drills are now at work. A good output is expected from these pits. Kingston will be the shipping point for the ore from this mine.

Little or no work has been done at the Blake mines (Lot 11, 9th Con., Loughboro) since last summer, but operations were again resumed on the 21st ult., a small force being employed. The outlook is reported promising.

The Rock Lake mines, (Lot 21, 11th Con., Storrington) operated by Messrs. Bell and Claxton, on which a small force was employed during the latter part of last year have increased their working force to 30 men. About 500 tons have been raised to date. The ore is being hauled to a shipping point on Lake Opinicon, quarter of a mile distant from the pits. This is reported to be a most promising property, and the owners confidently expect to produce at least ten tons per day. The phosphate occurs in true veins—not in the "pockets" so characteristic of the mines of the district.

Messrs. Jas. Richardson & Son, Kingston, are working in a small way at their Orser mine (11 in the 11th Loughboro). This is a new property giving favorable indications of being a producer in the near future.

The Sydenham Mica and Mining Co. has resumed operations with a small force at the Eel Lake mines, Township of Loughboro.

Among the other parties mining phosphate in this district are:—Messrs. Swan Bros. at Gould Lake; the Gould Lake Mining Company (Grant & McLatchie) and Capt. Hibbard on Lot 10, 8th Con., Loughboro. An average number of 10 men is employed on these properties.

MINING NOTES.

Nova Scotia.

Miscellaneous.

The next regular meeting of the Gold Miners' Association of Nova Scotia will be held at the Halifax hotel on Thursday afternoon, 3d July, at two o'clock.

It is expected that the new railway from the Pictou coal field to Oxford on the Inter-Colonial railway, near Springhill, will be open in a few days. The saving in distance amounts to about 10 miles for coal going to Quebec as compared with the present route.

Work at the Cape Breton and Nova Scotia collieries continues good. The contracts made in the Province of Quebec are in excess of those made up to the same date last year. Freight and prices are also much about the same. The Cape Breton collieries bid fair to become an important source of supply to the European markets in the near future. Some delay in the transhipment of the coal at the wharfs at Montreal was occasioned by a strike, but this has happily terminated and unloading goes on briskly as usual.

Mr. E. R. Faribault, and party of the Survey, have resumed their examination of the gold areas and are now at work in the district of Musquodoboit.

Mr. Hugh Fletcher, who has done so much sound and thorough geological work in the province, will leave for the Pictou Coal fields in the beginning of next month.

The Tenny Cape Manganese Co. (Limited) which was incorporated last session of the Legislature, as its name implies is a company formed for the purpose of purchasing, mining, shipping and otherwise engaging in the manganese business. It has a capital stock of \$200,000 and is composed of several New York men of known standing and ability, together with several men from the province. They have purchased a large manganese property on the well-known belt of that mineral in Hants county and intend to operate immediately. The Tenny Cape and Chivirari districts contain the most continuous and best beds of ore now known in that province, and the property purchased by the above company has already been worked and has proved valuable which, together with its excellent location for shipping, guarantees them, with the outlay of some capital, a handsome return for their investment. The ore is of high grade and the demand unlimited.

Gold Mining Supplies.

The principal depot in Nova Scotia, carrying the most complete assortment of first class goods, is

H. H. FULLER & CO'S

41 to 45 Upper Water St., Halifax, N.S.

Our line comprises Explosives, Fuse, American and English Mill and Hammer Steel, Bar and Bolt Iron, Steel Wire Hoisting Rope, Hemp and Manilla Rope, Rubber and Leather Belting, Miners' Candles, Oils and Lamps, Miners' Tools, Machinists' Tools, Blacksmiths' Tools, and every requisite for the gold miner.

H. H. FULLER & CO.,
Halifax, N.S.

Dr. A. R. C. Selwyn, Director of the Geological Survey, is now in the province with the object, it is said, of having an investigation made by Dr. Bailey into the geology and minerals of Colchester County.

The Nova Scotia Steel and Forge Company, of New Glasgow, has been merged into the Nova Scotia Steel and Iron Company, with a capital of \$2,000,000, divided into 10,000 ordinary shares and 10,000 preference shares, and a debenture capital of \$600,000. The company last named has been formed to extend the present business, also to take over the iron areas, railway franchises and other franchises of the New Glasgow Iron, Coal and Railway Company, and to erect blast furnaces, mine iron ore, and carry on all work necessary for the operation of the furnaces and the manufacture of iron and steel in all its branches. The provisional directors of the Nova Scotia Steel and Iron Company are: Thomas Bayne, Halifax; John F. Stairs, Halifax; Frank Ross, Quebec; William Jacks, ex-M.P., Glasgow; James D. McGregor, James M. Carmichael, H. S. Poole, George F. McKay, Graham Fraser, Harvey Graham.

The Springhill colliery has been troubled with heavy water from spring rains, but their battery of six pumps has kept the workings clear. The Joggins colliery has started its season's shipments.

The Acadia colliery is running a double shift, pending the erection of a more powerful winding engine.

Salmon River District.

The Dufferin Mining Co. held a meeting on the 10th inst., and organized under the charter given by the Provincial Government, session before last. The mine is understood to be looking better than it has done for some years.

Oldham District.

The property of the Oldham Gold Co. was sold by a Master of the Supreme Court at public auction on the 10th inst. at Oldham. The property, consisting of some ninety-six mining areas, with stamp-mill, engines and a good mining plant, was knocked down to Mr. T. P. Putnam, of Lower Onslow, N.S., for the sum of \$22,850. This property has practically been idle for over two years.

The Standard Gold Co. at Oldham are erecting a new shaft-house on the Consolidation shaft, which will be equipped with pumping engine for the plunger pump, and also 20-h.p. hoisting engine for the skip. It is expected to have the new gear running by August 1st, when the old east shaft will be abandoned and all rock and water will be taken to the consolidation shaft. This company is reported to want good miners badly.

Waverley District.

The miners of the Lake View Co. were notified on the 2nd inst. that the mines were to be shut down for an indefinite period, pending the erection of the stamp-mill it is supposed. Manager Hayward is keeping the water out, but no men are employed under ground. A large force are employed in the mill.

The Palgrave property has passed into the hands of "The Nova Scotia Syndicate, Limited." Mr. Gowland has been superseded by Mr. MacDuff, who has taken the management of the Syndicate's property, and has begun vigorously a reformation much needed in the company's former methods and system.

Gold River.

The mines of the Neptune Co. have been closed for an indefinite period, and only a watchman is in charge of the property. Mr. C. E. Willis, the former manager, has his whole time occupied with the management of the Central Rawdon property.

Malaga District.

The Parker-Douglass Co. are still increasing their extensive surface plant, and are at work now upon the machinery for the transmission of power from the "wild cat" run to the mines. This company also intend equipping their latest purchase (in Whiteburn) with a new mill and other machinery.

The other properties in this district are in the category of prospects, but have a very promising outlook if development work is properly carried on. The district is a good one, but has had a set back through too vigorous and misdirected "booming."

Quebec.

At the annual meeting of the Dominion Lime Company the following directors were elected:—Frank Jones, Portsmouth, N.H.; F. P. Buck, W. B. Ives, M.P.; T. J. Tuck, J. G. Robertson, Sherbrooke; R. H. Pope, M.P., Cookshire; Geo. Van Dyke, Lancaster, N.H.; C. H. Sinclair, Boston, and J. P. Cook, of Salem, Mass. The affairs of the company were found in

a healthy condition, and with the increased railway connection the business outlook was most encouraging. The Upper Coos and Hereford railway, recently leased by the Boston and Maine railway, connects the works more directly with the large railway system of the latter road, and opens a wider market for the product of the kilns.

We are informed that the trade of the Bell's Asbestos Company, Limited, for the past quarter shows an increase of 1½ per cent. over the same period of last year, and that most of the large customers who had withdrawn their custom for a time are now returning. There is every expectation of a satisfactory interim dividend being paid both on the old and new shares next month. The raw material is being sold at as high as £45 per ton, as compared with £18 last year, and there is every prospect of getting still higher prices during the remainder of the year, the latest price received from New York being £53 per ton. Late advices from the mines are most encouraging, and point to a larger output this year than ever before.

Ontario.

Sudbury District.

Recent advices from this district show that work on the mines operated by the Canadian Copper Co., the Dominion Mineral Co., Messrs. Vivian & Sons and others is being carried on vigorously. In anticipation of the operation of new Ontario Mining Act, quite a number of prospectors have arrived, and an unprecedented rush of prospectors into the district is expected this coming season. Besides, a good many of the mining speculators, having found out that undeveloped properties cannot be sold at any price, are preparing to open their claims this year.

Port Arthur District.

Numerous new discoveries have been made of late in both the outside country and among the working mines. The new veins which have been traced and are being developed at the Badger and Beaver mine properties are extremely encouraging, some of them showing silver freely near the surface. Renewed activity is also taking place at the Porcupine mine, which was recently pumped out, and to which the roads are being improved with a view to active development by the Badger Silver Mining Co., by whom it has been acquired. The stamp mill at the Beaver mine is now busy day and night, and a long steady and valuable output will doubtless follow.

Development at the mines of the Badger Silver Mining Company is being vigorously prosecuted upon the new vein, 350 feet to the northward of the old vein, Badger No. 1. From all indications the new find is the main vein from which the old vein, out of which about \$250,000 worth of silver was taken in 1889, was a stringer. The new vein measures five feet in width, is heavily mineralized, and carries an average of 1,757 ounces of silver to the ton; as far as prospected, it is steadily increasing in richness and promises to exceed in value anything hitherto opened in this district. The same vein has also been discovered by cross cutting on the west side of the mountain, 2,500 feet from the discovery shaft. It has the same width there and carries equally rich ore with that at the point of first discovery. A steam hoisting plant has been put to work at No. 1 end or discovery shaft. Sinking and drifting is being vigorously carried on on both sides of the mountain. The force of miners has been largely increased, and the output of the Badger for the coming season may be expected to exceed anything in the history of silver mining on the north shore of Lake Superior.

The Silver Mountain mine is reported as showing extra vigor since the advent of the new manager. A new promising vein on this property will likely be tested and in a thorough manner shortly.

The Crown Point mine has changed hands, or rather a one-half interest has been purchased by some Duluth people, who already have considerable invested in Thunder Bay lands.

Other finds north-east of the Beaver are being eagerly taken up by capitalists who are anxious to try their luck in this well established section of country.

The Dominion Government are again recognizing the value of this section in a mineralogical point of view. No less than four members of the staff are now working out the geology and topography of the country west of Port Arthur.

The Silver Islet Co. has employed Captain Frethering to look over their numerous and extensive mineral locations around the north shore of Lake Superior. One of the directors of the company accompanies him in a tug chartered for the purpose.

The Canadian Mining Review

CONDUCTED BY . . . E. T. A. BEL

OFFICES:

UNION CHAMBERS, 14 METCALFE ST.,
OTTAWA.

Vol. IX. JULY, 1890. No. 7.

Special Notice to Subscribers.

In response to the requests of many readers of the REVIEW, particularly from those resident in the mining districts, who find it very inconvenient to remit the odd amount of our present subscription price, we have to announce that henceforth the rate per annum per copy of the REVIEW will be two dollars instead of one dollar and fifty cents as heretofore. All subscriptions, therefore, falling due on and after the 1st August next will be charged at two dollars. This change will not affect members of clubs and associations subscribing to the REVIEW under agreement. In view of the permanent enlargement of the REVIEW, and the many new and improved features which have recently been made, and are still further contemplated, we trust that all our readers will heartily coincide with this arrangement.

The Ontario Mining Operations Act.

The people of Ontario are acting wisely on the principle that prevention is better than cure. Although as yet this province is not prominent for mining, there can be no doubt that its progress in this line will be rapid, as research opens newer and more valuable deposits. An Act of this nature introduced now will work the more easily in the future, when those investing in or working ores find that there is an Act regulating their mining, already cheerfully acquiesced in by their predecessors. The Report of the Commission recently published shows that there is a wide and varied mineral field, that Government aid is needed, and that every effort should be made to attract domestic and foreign capital.

The Act passed last Session, and relating to the working of mines, is based on the British Act of 1872. The new English Coal Mines Act, which came into force January 1st, 1888, would have afforded several valuable suggestions to those engaged in framing this Act. The definition of the term machinery, which is made to include tools, is, when taken in connection with the section in the general rules requiring the fencing of dangerous parts of machinery, rather cumbersome. The fixing of the age of first employment of boys at fifteen is a good plan in the case of metal mines, but there can be no valid reason why women should not be employed at the lighter surface work. Attempts were recently made in England to prohibit women's work above ground, and the matter was fully discussed, but the latest Act makes provision for their employment, the regulation of the conditions accompanying their work being, it is believed, subject to the Factories Act. In this connection it may

be remarked that women would be precluded from undertaking any clerical work about a mine.

Section 10, subsection 2, says that a mine owner may make return of the amounts and value of the mineral raised or sold every year. As under the census and other laws power is given to compel such returns it seems a pity that the rule adopted in some countries of making such returns compulsory could not have been adopted. Experience has shown that producers of raw or manufactured articles are ready to give details of their work if they find that they are legally required, and have an assurance that their returns will not appear, and will only form an unseen item in a total. The importance of exhaustive and correct mineral returns is nowhere better recognised than in the United States, whose Geological Survey has for the past eight years issued most valuable and interesting mineral statistical reports. If there were in Canada a law compelling such returns the Canadian Geological Survey statistical report would show an increase of twenty per cent. in a year—in amounts and values. The Ontario Government would find a greater profit in such returns than in compelling mine agents to keep registers of names, ages, residences, etc., of boys, when the crucial point, their ages, cannot be in many cases tested or proved.

Section 11 requires that a personal injury from "powder" should be reported. It would have been better in framing an Act for Ontario, where presumably high grade explosives would be largely used, to have adopted the wording of the latest English Act, and to have used the words "any explosive," as the 2nd sub-section would seem to point to the accidents not arising from explosions.

Section 12, subsection 1, would similarly have been improved by adding the words "or for a new deposit at such mine," and under the wording of the Act any mine not worked by a shaft is not required to give notices under subsections 1, 2, 3. The use of a sign board to warn people against abandoned shafts is a good one, but the alternative of "fencing" is better for cattle, and in the dark.

Under section 15 the inspector is given power when he considers any matter, thing, or practice about a mine dangerous or defective to require it to be remedied. In England the law on this point recognizes the fact that within the bounds of permissible mining there are wide divergencies of practice, and that custom, impelled by necessity or competition, had adopted systems of mining and of treating ores, which, if open to condemnation on broad principles, are safely carried on by the exercise of skill and attention. In order, therefore, to secure the skill of the individual operator, the English law allows him an arbitration whenever he is called upon by an inspector to make a change that appears unreasonable to him. It will probably not be long before the Ontario inspectors meet mining engineers, who will kick vigorously

against the exercise of so potent an authority as this, which might often call for changes involving heavy expenditures.

Under section 2 of the general rules experience has shown that the storing of any quantity of explosive in the mine is objectionable, and impartial observers fail to see how the Minister of Agriculture can pronounce iron or steel pricklers safe in one mine and dangerous in another, in view of the fact that even copper has been found to ignite charges. It would be advisable to forbid the unramming of high explosives as well as of powder, and in all cases it is better to leave a lost charge and drill a new hole close to it, as ordered in the English Act of 1888.

Apart from these criticisms which are offered in a friendly spirit, as the earth below is a common heritage as well as the sea, the Act is a good attempt at meeting the dangers which are often forced upon the miner by the greed or ignorance of his employer. The miners themselves should study the Act and bring to the notice of the Department any infringements, and when these charges are made clearly and properly and not maliciously, no doubt prompt attention will be given to them. The responsibility of the miner in regard to his own life and the safety of his comrades should be borne in mind, and it would not be amiss to have in the Act provision for special rules for the workmen and firemen so that they can clearly understand their liability and duties.

The Act is a much more creditable production than the first attempts at mining legislation in the United States, and the Ontario Government having made so good a start will no doubt see that it is carried out to the benefit of both miner and capitalist.

The Springhill Strike.

The collieries owned and operated by the Cumberland Railway and Coal Company at Springhill are at present idle, the men having gone out on strike during the latter end of last month. The men demand that the system of not counting a box with stone in it shall be discontinued, and that a certain scale of dockage should be laid down based on the percentage of stone in the coal. The statement of the men is submitted to the public as follows:

"In the month of January last there were 542 boxes of coal docked, about 450 boxes for February and the same number for March. This was at one slope alone. An equal number nearly was docked at each of the other two slopes, the value of which was \$1,614. For those three months, or in one year at the above figures, the coal cutters of Springhill would be robbed of \$6,556. Pioneer Lodge, representing a large majority of the workmen of Springhill, interviewed the manager and general manager and tried to have the matter adjusted.

After four or five weeks continuous running without any satisfaction, it was decided on the

17th of June to give the general manager until 21st June to make redress of the grievance. The committee waited on him on the latter date, and for his final answer were treated to the remark, 'The men have got all the satisfaction they ever will get.' The committee reported the result of this interview to the Lodge on Saturday evening, 21st June. It was then decided that Mr. Cowans be notified that the men would suffer to be locked out until the grievance was redressed.

It may seem strange that coal should be sent up with stone in it, or boxes sent up not quite full, but when it is made known that, in some cases, men work places where the stone band is from 15 to 31 inches thick, get no consideration for cutting this stone, and only receive 27 cts. per box containing 1,700 to 1,900 pounds of coal, the public will say, surely, 'Little wonder if some small pieces escape detection in the dark mine.' The stone that escapes is composed of small pieces only. It can be proven that boxes have been docked because they contained a piece of stone no bigger than a man's hand. When the public further consider that a number of the worst places are worked with 'close' lights, they will conclude that the men have a substantial grievance and that something should be had for handling so much stone, which is among the coal. This stone, in many cases is not in one part of the seam only, but in four or five different places. For instance, there are 14 inches of stone in the middle of the seam; 3 to 9 inches about a foot above that, on the top about 7 inches, and a foot from the bottom there are from 2 to 6 inches more. All of this stone breaks up into minute pieces which the miner is expected to pick out and stow away for nothing, while digging and filling his coal for the small sum of 27 cts. per box said to hold 1,650 lbs., but actually holding 1,700 to 1,900 lbs. All that the men asked of the manager was that he would not dock boxes unless they contained, at least, 28 lbs. of stone. For that weight the men were willing to be fined 20 cts., and to forfeit the box wholly if 50 lbs. were found, but they were not willing to lose a box because one or two pounds of stone had been detected in it. In reference to docking for short weight, the men did not consider it right that a box should be docked without being weighed. If weighed and found to be short of the standard (1,650) they were willing to allow a deduction for shortage. To this as to the other, the general manager would not listen. He said he would do nothing other than he was doing. He reserved the right to dock at his good pleasure."

The claims of the men are, to a large extent, fair and reasonable, and a good deal of sympathy is expressed for them in their determined stand. The case seems to us to be a fit one for arbitration under the recent legislation of the Mines Department.

In the meantime the shortage in the deliveries of coal is causing some inconvenience to con-

sumers in the Upper Provinces. Many of the miners have left Springhill and are finding employment at the other mines.

Our Iron Interests in Ontario; Another View of the Report.

"The history of the iron industry in Great Britain," says the preface to the Report, "proves conclusively that its growth and prosperity have depended upon a knowledge of methods and processes." So much being known to the Commission, the assistance of practical knowledge of methods and processes should have been sought to aid in the preparation of useful information people will naturally turn to the Report for, and will seek in vain. While the book is evidence of great industry, the arrangement all that could be desired and the introductory geological portion clear and concise, it is to be regretted that straightforward dealing with the Report in the interests of iron mining and manufacture will very plainly expose a few important omissions. Something less of ancient history and of political criticism, and something more of scientific information would have been commendable. It is always well to remember that over past events the immortal gods have no control; and that criticism which ends in pointing to what should have been but has not been done is of little value to mortals in these worrying days when men need to direct all their minds to know what should be done and how best to do it. The geological member of the Commission tells us, in his part of the book, that "the iron mines of Eastern Ontario" are treated in "another part of the report," but search is fruitless for a comprehensive sketch of the geological features and lithological characteristics of Eastern Ontario. The Commission found but one iron mine in operation, but it would have been matter of easy exploration among the mines for samples, and of easy research among the American furnace records where Ontario ores have been used, to have obtained from these sources authoritative analyses of the iron ores of the province. Without this the estimates of working expenses and cost of production given in the report are crude and unsatisfactory. The computations of cost of iron smelting deal with the magnetic ores of the region between Hastings and Haliburton, and curiously differ very widely in the cost of ore:—

	Marmora.	Madoc.	Kinmount.	Snowdon (1).	Snowdon (2).	Howland.	Grhauser's estimate.
Tons of ore	2	2	2.25	1.75	2	2	1.66
Cost	\$ 4	3	6.89	1.80	5	2.33	8.17

The English syndicate or American capitalists whom fancy sees likely to descend upon the country at any moment in quest of knowledge

where they may best invest in iron smelting, will naturally be surprised to find that in the same ore region the cost of ore at the furnace will range from \$1.16 to \$5 a ton. If this should be matter of indifference to men usually so lavish of money and ignorant of business, it is reasonable to suppose they will be utterly unconcerned to know what and where ores may be found suitable for foundry iron, or for a car wheel mixture, or for special lines of steel. The report will not burden them with any information under this head. Lest it should be thought, however, that the criticism of the *Review* is altogether destructive, unstinted praise is accorded to the generous and faithful treatment of the subject of charcoal iron. A careful perusal of the Report should satisfy anybody that this manufacture should no longer await foreign capital for the enterprise. But the *Review* has not found in the Report any comment upon the preposterous misapplication of the bounty and protection offered the iron smelter which will happen if forty per cent. of the bonus be given to the American manufacturer of coke when a better native fuel is obtainable. The record of the Hinckle charcoal furnace at Ashland, built to smelt 80 tons a day and now giving on very moderate fuel consumption 125 tons a day, is proof that in the United States dense magnetite ores can be smelted as cheaply as with coke, while the iron brings a better price. The irregularities of fuel supply so often cited against the charcoal interest have been many times of late far exceeded through the operations of striking coke burners and the combination of coke syndicates. The advance in the price of coal the world over will also go far to reduce the advantage heretofore enjoyed by the foreign iron-maker.

On the preparation of magnetic ores for the furnace, the Commission remark that a quotation from Mr. Birkenbine recommending the "thorough roasting of magnetites" "applies more particularly to the mines on the Quebec side of the river." In Swedish practise all magnetites are roasted without exception. There is nothing in the report to warrant this comment of the Commission, nothing whatever to show that Ontario ores of this class should not be so treated. There was quite enough mention of sulphurous ore to the Commission to have prompted a more extended inquiry into the best treatment. The superior value of iron made from roasted ore and the wide extent of the practice in European metallurgy concur in recommending the roasting kiln. The oxydation attained in the kiln not only facilitates the reduction of the metal but the combinations in which sulphur is liberated. The Magnetic Separator may displace the jig in the concentration of lean ore, but will never serve the purpose attained by roasting, and it remains very doubtful if as a desulphurizer it is as economical. Magnetic separation is as yet a modern experiment: roasting iron ore has been advantageous followed for centuries.

On the subject of "the influence of commercial conditions upon mining industry" it would be strange indeed if the Commission had not a theory to offer. Their views on this subject, it may be premised without offence, are not likely to lead to any practical result. It takes a lot of talk and discussion to change commercial conditions. They are generally too organic in origin to yield to rhetoric. The largest users of iron ore in the United States are opposed to removal of the duty on foreign ore. Their interests in American mines, in making steel rails for mineral railways, in building steel ships for transporting ore, are greater than their interests in Canadian mines. The removal of the duty would not cheapen ore one cent a ton. Ore of uniform quality can be mined, shipped and brought across the Atlantic from Spain or Norway to Philadelphia or Baltimore for less money than it costs to put down Ontario ore in Cleveland. So far from commercial conditions having operated against the iron mining industry, it would seem they have been extraordinarily favourable. Thirty years ago very good ore was mined in Lanark and shipped to the United States. The existence of iron ore in various parts of Frontenac was known. The Lake Superior mines had not been opened. There was no fleet on that lake, but there was a considerable fleet on Lake Ontario. The demand for Canadian ore was met by supplies of waggon loads. The writer has a letter dated 25 years ago from a furnace owner asking for a cargo of ore from a mine from which a sample of 50 tons was taken. The mine was offered for sale in reply, and is for sale by the same owner to-day. A few years passed and Americans made some purchases of Ontario iron mines at prices which, in view of all the conditions, were simply enormous. Railroads were built, in certain instances largely with public money, but the miner paid the top-most charges for freight and shipment. The ores raised were of variable character, now excellent beyond all comparison, again carrying $1\frac{1}{2}$ to 4 per cent. of sulphur, sometimes titaniferous. The miners were neither sparing of capital nor enterprise. In fact, in many cases had they gone slower and worked with more economy the outcome would have been different. But the result must be chronicled, that many American investors have lost large sums in Ontario iron mines from causes which have had no connection whatever with commercial conditions. The lack of native enterprise and lack of liberal dealing in providing facilities for cheap transportation, the extravagant prices at which ore properties have been held, the variable character of Ontario ores, and the inability of mining captains to reach a regular daily output, have all operated to hinder the progress of iron mining in Eastern Ontario. Add to all this that labour has been relatively high-priced for some years past, and it will be seen that the American tariff has had little effect upon the value of

the few thousands of tons of iron ore sent to the United States.

The Commission do not appear to have realized that this low condition of the iron mining industry has been largely due to causes within the power of the business people concerned to remove; but owing to the lack of exertion at the proper time, while the development of mines elsewhere hastened on, the result has come about that from Eastern Ontario at least it is not likely there will be any remarkable demand for iron ore. The investments of American capital in this region have been profitless in the extreme, while the demand for capital for opening new mines in West Virginia and North Carolina is likely to be active for a long period. The large iron formation on the Canadian side of the boundary line in the Lake Superior region will no doubt bring in the usual speculative immigrant who will buy up valuable property at an insignificant price and then put forth every effort to get a railway built at the cost of the Province for the transportation of the ore. At this stage the property will be likely to find buyers among the class who have supplied the first comer with means, and the future course of the enterprise will depend on the quality and supply of the ore, cost of mining and transportation. It is difficult to see what benefit will accrue to the Province from this course of dealing, and in this connection the views of the Commission on mineral and laws come up for consideration. Every mineral calls for legislation suited to the exigencies of its natural conditions. A uniform land law for gold and iron mines is as absurd a production as uniform leases of such property. A prospector with a ten dollar dipping needle and a polled pick travels a few days through a wild region and discovers a large iron deposit. His adventures have not been perilous or otherwise remarkable, save the encounter with black flies and mosquitos, to which the Commission do not fail to refer. He buys 80 acres at \$1 an acre, and before getting his patent has expended for surveys, law fees and other expense as much more. He himself would not be able to earn at another business more than \$100 to \$200 during the time occupied in his discovery. The total cost of his discovery is about \$400. It is talked of in bar rooms and whispered about in the offices of mineral land agents, and other lots on the same "lead" are speedily taken up by speculators. There is no demand in the Province or out of it for this iron ore. The supply offered by the great American mines is ample and apparently inexhaustible. The price is not considered excessive, although some of the companies have declared dividends ranging from 30 to 100 per cent. a year. Before a ton of the mineral, in the instance presented, can be sold the people of this Province must put their hands in their pockets and build railroad docks and chutes perhaps, or largely help to do so by a

liberal bonus. If the ore is not smelted here who will get the benefit of all this liberality? If, with all the facilities we offer, ore is put down in an American port cheaper than American ores, the advantage is either to the American furnace owner or the American people at large. If we want a chance to work the dollars of our surplus into profit producing factors the common school arithmetic of the country is at fault if a better method cannot be found than that outlined, and for the maintenance of which the Commission are apologists. The case supposed as an illustration of the present law is an 80-acre location in which is a large iron mine. It may contain a million of tons of good magnetic ore. Let us suppose that to facilitate developments we offer iron bearing territory at 15 cents a ton royalty for any quantity up to half a million of tons, and 25 cents a ton beyond that. The property will yield the province \$200,000, in return for which the Province may be properly called upon to aid in the development of this and similar sources of revenue. But that is not the American system, say the Commission. Well, if the American system is one of public spoliation, what then? The Michigan, Minnesota and Wisconsin mines are giving an output of ten millions tons a year. The history of their development proves that they should be yielding to these States a royalty of 25 cents a ton, or \$2,500,000 a year. Here are some prices of North-Western Iron Company stocks in a dull market:—

	Par.	Buyer.
Ashland Iron Company...	\$25	\$55
Champion ".....	25	90
Chandler ".....	25	37
Jackson ".....	25	110
Lake Superior ".....	25	67
Norrie ".....	25	70
Pittsburg Lake Angeline Co...	25	170
Republic ".....	25	43

The Commission have faithfully given the opinions of eminent experts in favour of an impartial system of education applied to popular needs, and have as faithfully reported in favour of a partial system of education adapted to a non-industrial class, and applied so as to further a theory of educational centralization, rather than the development of the mining and industrial interests of the country. The Commission quote the opinion of Sir J. Lowthian Bell, the greatest authority of the day on the metallurgy of iron and steel, and an "iron king" also, that "as in France and Belgium a much better purpose would be served by establishing technical schools throughout the country, and that every industrial district has a preferential claim to London." But, say the Commission, "the circumstances of England and Ontario are widely different." Certainly they are not different in the fact that there are industrial districts distant from the metropolitan centre, and the industry under consideration is mining and metallurgical industry, which should always work together under favouring natural conditions. The education necessary to further industry, says Sir Lowthian Bell, and all others

whose knowledge enables them to speak with authority, must be given where it is required. To this the Commission can only reply, in illogical phrase, "One school well equipped would serve our present need, and nowhere else could it be so economically established as in connection with the practical "science department of the State University." This conclusion immediately follows the statement that "we have few trained men to fill any place requiring superior skill, either in mining or smelting or metallurgical works." Here is precisely the defect in the industrial condition of this country. No man in his senses, no company having any regard for dividends, will commit an industrial enterprise in which special technical knowledge of methods and processes is requisite, to the management of the graduate of any technical or practical school. Further training is necessary, and the mere student of practical or applied science must seek this in another country, where, if he displays any special aptitude, he is very likely to remain, especially if his own interest lies in so doing. This is the state of things now going on, and which it is sought to perpetuate in a worse form than ever. The most expensive production in this country is its young men whose education at enormous expense to the community is brought up to a point where it is of no use to the public or the possessors unless supplemented by employment we cannot offer or further training we cannot give. The expatriation of such is constantly going on, and it is no figure of speech that it is a drain upon the resources of this country greater than the whole burthen of taxation. Now, what remedy do the Commission propose for this state of things? None whatever. In a lecture delivered at University College, London, in December last by Dr. Wright on the subject of scientific investigation as applied to the manufacture of iron and steel, he declares that "applied science must be learned in the factory," where the student must acquire "the faculty of reducing to manufacturing processes the small scale operations of the scientific laboratory; to devise means for utilizing waste products in other directions, and in short to solve the varied problems that are continually cropping up in every industrial factory (and especially so at a blast furnace) upon the successful solution of which depends the possibility of the commercial success of one works as compared with another, or of one country as compared with another." Lack of space forbids further extract from this important lecture. It remains only that reference be made to the foundation of the modern Belgian iron and steel industry, which was in a languishing condition until that the King in 1823 invited Mr. Cockerill, an English iron master, to settle near Liege, and assisted him in the erection of iron works on condition that the iron masters of the country should be permitted to learn from him the true principles and latest improvements in the art. The result was the foundation of the

works of the great Cockerill company at Seraing, one of the most perfect establishments in all Europe. The evidence taken by the Commission together with this striking illustration of "the direct process" should have prompted them to recommend the construction by the government of a ten ton furnace in a locality where hydraulic power, charcoal fuel, and variety of iron ores would afford natural conditions favourable to success. A small Bessemer converter, open hearth furnace roasting kilns, magnetic separator and other plant for treating ores and manufacturing iron and steel by every approved process should accompany the blast furnace. The whole plant could be erected with a laboratory and necessary buildings for managers, lectures and workmen for \$100,000. It could be run for five years at a cost within \$100,000, with the result that we should have before the end of that period a trained body of furnace managers and a number of skilled workmen capable of applying in the language of the Commission, the "knowledge of methods and processes" to the reduction of the iron ores of Ontario and the manufacture of iron and steel. The works could then be sold, leased or maintained for the further education of young men as the experience gained would dictate. That any private concern entering into the untried field of iron and steel manufactures in this country will meet with problems it would be desirable to solve but which prudence will avoid, is evident; that the solution of others will be attempted to which experience worthless or profitable can only give the answer is also evident, but the result in any event will in all probability be concealed. What the country requires is knowledge and skill competent to guide its energies and develop its resources. The end can be attained only in the mode here suggested so far as the iron industry is concerned, but those interested in other lines of mineral development advance their particular views. It will be found that the industry whose interests are here advocated will lead, and if well directed largely assist the development of all others.

The Phosphate Corporation, Limited

The Phosphate Trust, to which some reference has been made in these columns, has at last materialized, and that, too, if we may judge from reports, in an eminently successful degree. From the prospectus we find on the Board of Directors the Rt. Hon. Lord Stalbridge, Sir James Whitehead, Bart., Sir Jacob Wilson, Sir George S. Baden-Powell, Hon. Cecil T. Parker, Sampson S. Lloyd, H. Mallaby-Deely, all men of high social status, of good commercial standing, and of excellent business capacity. The list of Founders is also a notable one. It is headed by the Duke of Westminster, who is followed by the Duke of Richmond and Gordon, the Duke of Portland, the Duke of Sutherland, and the Duke of Fife. These five

dukes are succeeded by a marquis, two earls, six barons, and the Prince Camille de Polignac. Then come a number of other familiar names such as that of Sir James Whitehead, Mr. Mundella, M.P., Mr. Sampson S. Lloyd, etc., etc. Among other prominent Canadians whose names appear on the list we observe that of the Hon. C. C. Colby, Hon. J. J. C. Abbott, and Mr. Sandford Fleming. The capital is £1,000,000 sterling in £10 shares, whereof 500 are founders' shares, the respective holders of which, in respect of each share, shall, in addition to paying up the nominal amount of such share, apply for and take at least fifty ordinary shares, and pay the sum of £20 in respect of each Founder's share taken by him towards expenses antecedent to allotment. The idea upon which the General Phosphate Corporation is based is an excellent one. It proposes to buy well-selected phosphate properties in Canada and elsewhere, and to work and develop them. There are in the Dominion immense areas of rich phosphate lands, which only await the well-directed infusion of capital, and capable experienced management to amply repay investment. There are, on the other hand, many worthless properties, and many fairly good ones which are offered to the public, and will probably be offered to the Corporation, at prices enormously in excess of their actual worth, and which at once preclude any chance of a profitable return. In the original draft prospectus of this Corporation were included a number of such properties, puffed up with inflated estimates by a few so-called experts. At the time we strongly condemned any such basis for the foundation of any important syndicate seeking a solid return for their money. If the Corporation is to be a success it must carefully discriminate and closely investigate the properties which will be submitted to it for purchase; and when good properties have been secured, it must see to it that they are capably worked by men experienced in the best and most economical methods of working the mineral. If this is done the success of the Corporation is assured, and its efforts will prove an immense boon to the country in promoting and stimulating the development of similar enterprises.

Algoma Iron Region.—A Winnipeg despatch says:—A number of St. Paul gentlemen who have been prospecting in Western Algoma are here, *en route* home. They state that the iron prospects along the Minnesota boundary on the Canada side were remarkably good. The district was recently visited by the Assistant State Geologist of Minnesota and a Philadelphia expert. They were immensely pleased with the whole iron district tributary to the Port Arthur, Duluth & Western Railway. An iron expert has examined some of the locations which the Kingston & Pembroke Mining Co. are said to contemplate buying, and was much impressed with the outcroppings on the Minnesota side. All the American mining companies contemplate active mining work as soon as the railway reaches the boundary. As their output has to be shipped in bond *via* Port Arthur, several strong companies have been organized. On the Atikokan range claims have recently been located, and exploratory work done. One bed of ore has been uncovered, and shows a width of 46 feet of ore, which is magnetic, free from sulphur, phosphorus or titanium, and will average 68 per cent. of metallic iron.

Our Portrait Gallery.

[A series of portraits and biographical sketches of Canadian mining engineers, mine managers, inspectors, geologists, explorers, etc.]

No. IV.

Mr. Archibald Dick, of Nanaimo, B.C., Inspector of Mines of British Columbia.

Mr. Archibald Dick, the Inspector of Mines for British Columbia, resides in the City of Nanaimo, Vancouver Island, B.C.; he was born near Kilmarnock, Ayrshire, on the 25th December, 1841; his father was Mr. James Dick, of that place, his mother Sarah Muir, daughter of Mr. John Muir, of Quarter, near Hamilton, Lanarkshire, Scotland. Mr. Archibald Dick accompanied his parents and their family, who left in 1865, to Vancouver Island, where his mother's brother, Mr. John Muir, and his family had long been settled. As the Muir branch of the family is largely represented in Nova Scotia, as well as in British Columbia and other parts, it will be interesting to make a few characteristic quotations from the History of British Columbia, where the venerable historian, Bancroft, relates that in Vancouver Island "Fort building was still in progress when the "Scotchman Muir, with wife, daughters and sons, arrived at Fort Rupert. "Among them was Michael, born at Kilmarnock in 1840. A shaft to the depth "of ninety feet (subsequently deepened "to 120 feet) was sunk by the Muirs, who "after further examination pronounced "the seam too small to be workable. "Troubles arose with the natives, who demanded pay for the land or its product; "and when the white men refused, the "savages surrounded the pit, threatening "to kill all present should they persist in "their robbery. Prospects were better at "Nanaimo, and thither, in the spring of "1851, Muir proceeded with all his men "and mining machinery, leaving Fort Rupert in possession of the traders only. "Muir arrived at Nanaimo with the men and "machinery. The steamer 'Otter' brought "them thither, and Governor Douglas (after "wards Sir James Douglas) met them there. "The machinery was landed and set up, and "measures adopted for defence. Muir's force "was small, and should the natives grow jealous "or mercenary, as at Fort Rupert, they could "do but little that year; nevertheless they prospected and dug heartily, wasting no time." Thus first opening and starting the coal mines at Vancouver Island which have been so successful and famous since.

Mr. Archibald Dick, on his arrival at Nanaimo, was an experienced and capable miner, in the true sense of the term; and at once found scope for his energies in the mines of the Vancouver Coal Mining and Land Co. (Ltd.), then under the management of Mr. John Bryden (formerly of Ayrshire, now general manager of

the Wellington Colliery, V.I.), where he was engaged for four years. In 1869 Mr. Dick thought he would try his luck at the gold fields of Cariboo, in British Columbia, whither he and many others resorted: meeting with but moderate success, he returned to Nanaimo in 1872, having however graduated in the higher branches of mining, to his complete satisfaction.

During the succeeding five years Mr. Dick was chiefly occupied in prospecting and exploring for coal on Vancouver Island, on his own account as well as for certain of the collieries.

The managership of the Baynes Sound Coal Company was in 1877 offered to Mr. Dick, who accepted the position and carried on the mine until the company were satisfied that operations



could not be profitably continued without a large outlay of capital. By virtue of his position with this company he was entitled to and obtained, we believe, under the Coal Mines Regulation Act (when first passed in the Province), a certificate of service. Those persons who held situations as mine managers for a stated period previous to the passage of this Act were granted certificates without undergoing an examination.

In 1880 Mr. Archibald Dick was appointed the Inspector of Mines for the Province of British Columbia (succeeding Lieut.-Col. Edward Gawler Prior, M.P. for Victoria City, B.C.), and has since that time worthily fulfilled the arduous and onerous duties of that office, to the general satisfaction of the public.

Mr. Dick is Chairman of the Board of Examiners for granting certificates of competency to

colliery managers under the Coal Mines Regulation Act of British Columbia.

In his official capacity Mr. Dick maintains a strict adherence to duty, and he has proved faithful always in the performance of it. On the occasion of a most disastrous explosion a few years ago at one of the Nanaimo collieries he exhibited that quiet bravery which, in a man in his position, is exactly calculated to inspire confidence. As a citizen he shows positiveness, zeal and purpose. Steady and reliable in all his undertakings, Mr. Dick possesses in an eminent degree those traits which, in the common parlance of Englishmen, come under the name of honor. He is one of those men who, if he gave his word, would feel as much bound as if he had given his bond. In a word, he is a man of high integrity and sterling worth.

Mr. Dick has made Nanaimo his home, and was married on 1st January, 1879, to Elizabeth Clara, third daughter of the late William Joseph Westwood and eldest daughter of Fanny Westwood, of East Wellington, near Nanaimo, and has six children, three boys and three girls.

The Cost of Charcoal Pig-Iron.

From the recent report of the United States' Commissioner of Labor it appears that the cost of making charcoal pig in the United States traverses a wide range of figures, not only for raw material but for labor. The latter evidently bears relation to the size of the furnace, being \$1.46 at a 40-ton furnace in the south, \$1.20 at a 75-ton Lake Superior furnace, and \$3.59 at a 20-ton Maryland furnace, where ore at \$10.29 and fuel at \$7.30 for the ton of pig, with other large charges in proportion to output, bring the cost of the metal produced up to \$23.16½ a ton, and this without counting insurance, interest and depreciation of plant. The cost of Charcoal per ton of pig varies from \$5.54 at the south on very low grade hematite ores to \$9.05 at a Lake Superior furnace on the richest of magnetic ore. The cost of ore per ton of pig runs from \$1.98 in Tennessee to \$6.93 at Lake Superior. The total charges given for southern iron are \$10.28; for Lake Superior from \$14.45 at a 60-ton furnace to \$18.78 at a 12-ton furnace. The low cost of southern coke and charcoal iron has resulted in an immense industrial development, not without serious disturbing influences upon northern and eastern enterprises; but the south is evidently not an ironmaster's Paradise yet, seeing that the last market reports state that "many furnaces are shut down owing to trouble with workmen in some instances, and lack of ore and coke in others.

LETTERS TO THE EDITOR.

Ontario Iron Ores.

The Editor:

SIR,—“The Mineral Resources of Ontario,” lately published under the auspices of Mr. Archibald Blue, well deserves the favourable notices which it has been receiving from the press of the United States and Canada.

Mr. Blue has, with pains-taking care and judicious arrangement, put together facts most important both to prospectors and to miners in a practical manner that can be readily understood and used by all.

A good deal of space is devoted to our iron ores and the facilities for smelting them in Ontario.

No doubt one or two charcoal furnaces might find profitable employment in Ontario, but there is not much encouragement for capitalists to invest extensively in that line until we have a larger market.

Although the Dominion Government has imposed higher duties on imported iron and offers a bonus for domestic production, our iron manufactures, which are the most important of all industries, are growing very slowly.

It is time for our Government to recognize the fact that neither high import duties nor bonuses will give us customers for our iron or create a market, and it is the customers and the market we want.

We have abundance of excellent iron ores, and all that we can do with the greater part of them is to seek a market in the United States.

Unfortunately there is at present a prejudice in some parts of the States against Canadian ores. There is some reason for this, caused doubtless partly by the dishonesty or ignorance of those who have engaged in the business. But it is very unfair to condemn all Canadian ores because those from parts of one or two counties in Ontario have not proved satisfactory.

Many of our iron ores occur in the same geological formation in which the best Michigan and Minnesota iron mines are found, and there is no reason why some of our deposits should not be equally valuable when properly developed.

There are a dozen counties in Ontario in which iron ores are found, including the districts of Algoma and Thunder Bay, extending over several hundred miles, besides excellent ores in considerable variety in Nova Scotia, near the Atlantic coast, and in British Columbia near the Pacific.

Mr. W. J. Rattle, M.E. and metallurgist, of Cleveland, Ohio, an expert of high standing, gave valuable evidence before the Mining Commission. Mr. Rattle said: “I am very well satisfied with the outlook in this ‘country’ (Eastern Ontario). I judge the iron ores to be ‘of good quality, and think the prospects are sufficient’ to justify reasonable development, both of magnetites ‘and hematites.

“I believe you have a magnificent outlook for iron. I think these Ontario ores would be easy to smelt, as much so as our ores from Lake Superior. The ores ‘here carry lime largely, and you would require very ‘little flux. You have ample supplies of ores here to ‘make the best quality of steel rails, and in sufficient ‘quantities to start a blast furnace.”

This opinion, given from his own observations by an expert of such wide experience as Mr. Rattle, should be a complete answer to those critics who question either the quantity or quality of our ores.

The following analyses of some ores from the Kingston and Pembroke District show them to be of excellent Bessemer quality, namely:—

Metallic Iron.	Phosphorus.	Sulphur.	Silica.
66.	Trace.	Trace.	2'14
65'33	0'017		
64.	0'025	Trace.	5'27
62.	0'006	Trace.	4'12
60.	0'009		6'31

With no titanium in any of them.

Yours, &c.,

T. D. LEDYARD.

Toronto, July 21st, 1890.

Messrs. Quigley & Hammond, of Fort William, located some iron lands last week 35 miles west of Port Arthur and 5 miles south of Finmark station on the Canadian Pacific Railway. The outcropping is 1½ miles in length, and has an average width of 50 feet; assays by F. Hille, M.E. & Ch., Port Arthur, gave 61% metallic iron. No titanium or appreciable quantities of phosphorus or sulphur.

The Miner in Relation to Mineralogy.

J. T. Donald, M.A., Montreal.

The rare elements are not nearly so rare as they are commonly supposed to be; if they were more frequently sought for they would be more frequently found. So read the writer in a treatise on chemistry some time ago, and since that time the statement has frequently been called to mind in connection with visits to some of our Canadian mining areas.

If the mining captains of our various mines be asked if they have any specimens of the minerals found associated with their ores, very probably the reply will be, “No; we have nothing here except ore and rock”; “ore” meaning whatever mineral is being mined, and “rock” including everything else. Not infrequently in such cases a few minutes’ search over the dump leads one to say interesting mineral specimens are not nearly so rare as they are supposed to be; if sought for they would be found.

It is matter for regret that so many of the men in responsible positions in connection with our mines are so indifferent to the occurrence of minerals associated with their ores. Should one give utterance to this sentiment, very probably the reply of the miner will be, “What is the good? We have no time for anything else but getting out our ore. No money in that,” etc., etc.

Now, the question is: Is the miner right in thinking it is vain and unprofitable for him to be on the look-out for minerals that may occur in association with the ore he is mining? Certainly I think he is very far wrong. We are told the discovery of the Florida phosphate deposits was made by a man who had his eyes open to see what could be seen, and was inquisitive concerning what he saw. The *Engineering and Mining Journal*, speaking of the discovery, says: “In the last fall some progressive orange grower, with a little more curiosity than his neighbors, sent to a chemist a sample of white sub-soil that occurred in his grove; the chemist reported that it was eighty per cent. phosphate of lime; the secret got out, and then the excitement began.” The basis of this discovery, then, was in the fact that this orange grower observed that his sub-soil was peculiar and then imagined the cause of the peculiarity. Take another case: In the Sudbury district the valuable metal platinum has been discovered, as the result of examining the mineral associates of the ores of that district; and in the case of the Villeneuve mica mine interesting compounds of uranium have been found. Did the same intelligent inquiring spirit exist to a greater extent, it is altogether likely we would know of the occurrence of many more interesting mineral localities in Canada. There is yet room, abundant room, for the exercise of this intelligent enquiry in connection with our mines. Take, for instance, our asbestos mining region. It has long ago been pointed out, both by the Geological Survey and by Dr. T. Sterry Hunt, that nickel is seldom or never absent from the serpentines and associated rocks of this region; indeed, Dr. Hunt has predicted that the nickel so generally diffused through these rocks would in places be found in workable quantities, a prediction which as yet has found only a partial fulfilment in the operations of the Orford Company some years ago.

Still farther, the celebrated nickel ore of New Caledonia is a hydro-silicate of nickel and magnesia, and we are told the nickel ore is found associated with iron oxide and chromic iron ore, in beds of serpentine. Surely to those who know how frequently magnetic oxide and chrome iron cut the asbestos veins, no more need be said to show that it is worth while for the asbestos miner to keep an eye on any unusual looking mineral he may meet with in his mining operations.

Even if mining is being carried on in an area where there is no likelihood of finding any mineral or ore of commercial value, there is still no slight advantage to be derived from an intelligent inquiry into the nature of the various minerals there occurring. The finding of minerals or fossils in certain associations may be the key to the solution of the problem as to the origin of the deposits of economic value, and the solution of the problem may, in various ways, confer great benefits upon the industry in question as a whole.

But even in cases where no commercial advantage, either direct or indirect, can accrue from the lookout for associated minerals, we may not say that the quest has been in vain. The habits of observation and comparison induced by being on the lookout for minerals are of inestimable value to the miner himself, and cannot fail to render him more proficient in his calling, and, at the same time, add more or less to the sum total of knowledge. It may be urged by the miners that even though they could be on the watch for the occurrence of interesting minerals associated with their ores, they have not a sufficient knowledge of mineralogy to enable them to determine what are the minerals they may find, and therefore they would not know if they were finding anything of value or of interest. This objection need be no excuse, for the officers of the Geological Survey will gladly examine any mineral sent in to them, and in addition there

are numerous chemists and mineralogists located here and there throughout the Dominion, and I am sure there is no one of these who has not sufficient love for science to be pleased to aid the inquiring miner by identifying any unusual looking specimen he may have met with.

Mine Maps.*

Among the primary necessities of every well-managed colliery is an accurate and complete map of the inside workings, showing not only the outside improvements, but the physical characteristics of the tract to be worked, as well. When we say an “accurate and complete map,” we do not mean such apologies for maps as are in use at many collieries, and which are nothing more than approximate outline plans of the main workings. Such maps are regarded by some mine owners and superintendents as “good enough,” and they cannot see the wisdom of going to the expense of employing competent engineers to make them maps that will in the course of a very short time, prove not only a source of great satisfaction to them, but will prove their economy as well. Such maps cannot be constructed by boys. Neither can they be constructed by the class of incompetent surveyors that call themselves “engineers,” and are willing to work at their “profession” for \$50 or \$60 per month merely because this is more money than they can earn with the pick and shovel, or by tapping molasses and measuring tape.

The mining engineer is a professional man. His profession must have been acquired by years of work and study coupled with a good supply of that very necessary requisite in every profession—“brains.” It takes more study and harder work for a young man to become a competent engineer than it does for him to pass the legal requirements which enable him to practice law or medicine. His profession is one of great responsibility. Thousands of dollars may be either lost or gained in a single decision or act of his. The lives of the workmen in the underground workings often depend on his skill and accuracy. Notwithstanding these facts there are hundreds of collieries at which the book-keeper is paid more salary than the mining engineer under whose direction the colliery should be worked, but often is not.

A mine map may be accurate, and still not be complete. Such maps can be constructed by good surveyors. They can make an accurate survey, and keep their instruments in adjustment, but as they only have a limited knowledge of the difficulties to be contended with in coal-mining, their maps are only outline maps, and are only of use in so far as they show the relation of the inside workings to land lines.

The complete mine map should be a complete history of the colliery, showing also, indirectly, what its future may reasonably be expected to be. It should be constructed by men who do not work to get done in the shortest time, but by men whose main idea is to see how much information they can put on a map.

We do not mean to decry the accurate outline map. It is very good as far as it goes, and is infinitely better than none. But we want to impress on our readers the advantages of maps so constructed that the superintendent can see at once all conditions existing in a mine at all times.

To make a complete map, the engineer should first make a survey around the tract to be worked, locating all the prominent physical features and improvements. If he can do so, he should make a topographical map of the tract at once; but, if time is limited, by running the vertical as well as the horizontal angle, he can carry the tidal elevation, or the elevation above some assumed datum, to every station, and mark it on the map at that point. Then as he makes subsequent surveys, he can gradually get data enough to make a fairly complete topographical map in course of time. Every ledge of rock in place, should be located, and the amount and direction of its dip, as well as the character of the rock, should be marked neatly on the map. The streams of water on the tract should be regarded as of primary importance, and should be located with exactness.

After the surface survey has been made and plotted, a survey should be carefully carried into the workings and the same care taken in reading the vertical angles. Mark the elevation carefully at every station. Take the dip of the vein at every station, and oftener if it changes between stations. If the vein worked is a thick one, note how far the station is above the bottom slate, if above it at all. Note the thickness of the vein, and take frequent sections of it. Locate the ribs of all pillars with accuracy. Don't attempt to make a pretty map by drawing the sides of openings parallel to each other; draw them as they are. Note all pillars that have been robbed out, and those that have been skipped. Designate such pillars by some standard mark to distinguish them from pillars that still remain intact. In running the survey through a tunnel, take a section of it, noting carefully the dips and character of each bench of rock. Do the same in shafts. Take advantage of every opportunity to “tie up” the survey by connecting with some other branch of it by running through crosscuts or any other openings. Take advan-

age of the second outlet to carry the survey to the surface by a route different from that by which the mine was entered, and tie up with the outside survey. "Don't shove," is a short and appropriate expression.

If the surveys don't tie, don't shove them so that they apparently will; re-run them until you find the error that has thrown you out. If you have tied up at every opportunity, the chances are you will not have far to look for the error. Use what good sense you have been blessed with. This will direct you in regard to noting other features not already mentioned. Always bear in mind that your notes cannot be too complete. Don't be afraid of filling your note-book. Note-books are cheap, and they were made to be filled. Keep your notes as neatly and in as condensed a form as is consistent with clearness.

Base all your work on one meridian. If you have a number of collieries in the same neighbourhood, don't have as many different meridians, or you will never know how they lie in their relation to each other, and the difference in meridians will be an endless source of annoyance.

Test your instruments frequently and see that they are in perfect adjustment. Don't trust the magnetic needle if you want to make an accurate survey and map. Test your chain or steel tape as frequently as you do your transit. An inaccurate chain and a poor chainman are as great sources of error as a transit that is out of adjustment and a careless transitman.

Let your mine map be the ventilating chart of the mine. Mark the upcast and downcast plainly on it, and show the course of the air-currents by arrows.

With mine maps constructed on these lines, collieries can be worked more economically and with greater safety. More coal can be taken out at less expense, and advantage can be taken of innumerable natural and other features that, without such a map, would be lost sight of.

If a cross section is desired on any line through the tract, the data to construct it can be taken directly from the map. If a change is desired in the method of ventilating it can readily be planned on the map. If mechanical haulage is desired the necessary data for the mechanics can be taken from the map. If it is desired to rob pillars in any portion of the colliery the superintendent can see at a glance whether it can be done with safety to the outside improvements and the inside workings or not. If there are any streams on the tract they can be readily kept from finding their way to the inside workings, and thus the duty of the pumping engines can be kept down to a minimum.

Millions of tons of the finest coal in the anthracite regions have been lost simply because there were no accurate maps to guide the officials to their work. The writer has frequently seen pillars many times larger than there was any necessity for, and he has just as frequently seen them so small as to be entirely worthless, and the only means that the inside foreman had of determining the thickness of these pillars was by putting a hole through them. The importance of knowing the exact size of all pillars and the exact thickness and character of the strata between the surface, and mine workings cannot be over-estimated. The colliery official or owner who cannot appreciate this is an incapable man, and is unfit to manage a colliery.

If accurate, complete maps meant greater safety only, they would possess advantages that should force them into use at every colliery. But in addition to greater safety they mean greater profits as well, and there is no excuse but obstinate ignorance that tolerates such apologies for maps as are to-day used at the majority of American collieries.

In the anthracite regions of Pennsylvania mine maps are made that will perhaps excel those made in any other portion of the world in point of completeness and accuracy. In the same regions there are maps in use that are simply botches, and are, in many respects, worse than useless. Their inaccuracy is frequently the indirect cause of many accidents and great unnecessary expense, and the users are men who either are handicapped by superior officers who expect to have good maps made by incompetent surveyors because they are cheap, or they themselves follow this narrow line of thought.

If good maps were not in use, and if accurate work was really unreasonably expensive, there would be some excuse other than obstinacy and ignorance to offer for the use of inaccurate and incomplete maps. But obstinate ignorance must be the verdict when such companies and firms as Cox & Brothers and Company, the Philadelphia and Reading Coal and Iron Company, the Lehigh Valley Coal Company and a few others have their mine maps as complete and accurate as it is possible for well-trained and competent engineers to make them. There are other firms and companies that are gradually getting to a higher standard, but the majority of operators—both anthracite and bituminous—still work on with maps that, instead of being consulted at any time, should be promptly consigned to the waste basket, and the engineer corps promptly told to either make their maps with some degree of accuracy and completeness or to get out.

In this connection a word for the competent mining engineer will not be amiss. Mineowners have no right to expect him to spend his time and talents for less com-

pensation than they pay some members of their clerical force. If they want legal advice they pay a good lawyer a reasonable fee for it. If they happen to suffer from dyspepsia or any other ailment they pay a physician a reasonable fee, and the druggist a fat profit on his drugs, and never think of kicking. But if an engineer asks for a compensation considerably less than either the lawyer or doctor get, time and labour considered, they raise their hands in holy horror, and inform him that they can get men who will work for \$50 or \$60 a month. These latter are the parties that make the inaccurate and incomplete maps, and in the end always prove most expensive help.

* From the Colliery Engineer.

Phosphate Shipments.

The following have been the ocean shipments of Canadian phosphate from the port of Montreal to date:—

Date.	Name of Ship.	Destination.	Shippers.	Quantity.
June 17	SS. Fernside	Liverpool	Wilson & Green...	210
" 20	SS. Circe	Glasgow.	do	210
" 26	SS. Steinhof	H'mburg	Millar & Co.	300
" 26	do	do	Wilson & Green...	254
July 3	SS. Vedra	London .	Lomer, Rohr & Co.	150
" 4	SS. Amarynthia	Glasgow.	do	200
" 5	SS. Michigan	Liverpool	Wilson & Green...	249
" 5	SS. Alava	do	Millar & Co	450
" 9	SS. Toronto	do	Lomer, Rohr & Co.	200
" 10	SS. Alcides	Glasgow.	do	100
" 12	SS. Altmore	London .	do	250
" 12	SS. Cassins	H'mburg	Millar & Co	185
" 14	SS. Galveston	London .	Lomer, Rohr & Co.	100
" 15	Brk. Churchiston	Swansea.	Millar & Co	130
" 14	SS. Oxenholme	Liverpool	Wilson & Green...	554
" 16	SS. Sarnia	do	Lomer, Rohr & Co.	200
" 18	SS. St'ts of Magellan	do	Millar & Co	475
" 21	SS. City of Lincoln	do	Wilson & Green...	655
" 21	SS. Circe	Glasgow.	Lomer, Rohr & Co.	250
" 22	SS. Plessey	London .	do	90
" 23	Ashburne	do	do	290
" 23	Oregon	Liverpool	do (in bags)	100
				5502.100

SHIPPER'S RECAPITULATION.

	Tons.	Bags.		Tons.	Bags.
Lomer, Rohr & Co., (to 19th June)	2,715	100			
do (to 23rd July)	1,830	100			
Millar & Co. (to 18th June)	1,475				
do (to 15th July)	1,540				
Wilson & Green (to 16th June)	823				
do (to 22nd July)	2,132				
Total European shipments to date	10,515	200			

RECAPITULATION OF EXPORTS.

	Tons.	Bags.		Tons.	Bags.
Liverpool, previously reported	2,823				
do reported to date	2,993	100			
London, previously reported	1,265				
do reported to date	880				
Glasgow, previously reported	410	100			
do reported to date	760				
Hamburg, previously reported	515				
do reported to date	739				
Swansea, reported to date	130				
Total tons exported to Europe since opening of navigation	10,515	200			

The following have been the shipments of ground phosphate from the Ottawa Valley to the United States to date:—

To Holyoke, Mass. (previously reported)	647½ tons
To Chicago (to date)	125
Total tons	772½

Notes on Quarrying.

(Wm. L. Saunders, in Stone).

An old quarryman when asked how much it would cost to start a marble quarry, replied: "You will have to run your hands down into your pockets clear up to the elbow before you get any return, but when the money begins to come back, it will come back faster than it went out." There is no doubt about the truth of this when applied to marble deposits, and it might also apply to frequent quarry openings in stone of less value. There seems to be a peculiar charm about the possession of a marble quarry which has induced many a successful business man to give up that occupation in which he had been trained, and which had proved profitable, in order that he might revel in the fascinations of a marble quarry. It is almost invariably true that when a man has once become fascinated with the marble business he is irretrievably lost and can do nothing else. He indulges his fond anticipations of dwelling in marble halls, and figures up the enormous profit which must follow a business which produces a stone at \$1 per cubic foot and sells it at \$5 or even \$9. That there are millions in it seem to be perfectly evident. He gets his little specimens polished and carved in paper weights, horse-shoes, card receivers, &c., distributing them among his friends, and every one congratulates him on the possession of a property which contains such beautiful marble.

After organizing his company, or in many cases before such progress has been made, it is usual to write everybody who advertises himself as a manufacturer of drills to find out how much it will cost to do some prospecting on the property and produce a core. The value of this core drilling in a marble deposit is much over-estimated; though I do not share the opinion of many that it is entirely useless. It is certainly true that several instances may be cited where sound and beautiful cores have been taken out with a diamond drill, yet the quarry has produced little, if any, sound marble. A notable instance of this, and one frequently cited, is that on the Baker property in Central Rutland, Vt. Mr. Baker, sr., was in possession of a handsome piece of property at Central Rutland, and might have still been enjoying the mountain breezes of that beautiful locality had it not been his unfortunate lot to discover marble upon his property. Those who knew this genial old gentleman will remember his enthusiasm when talking to you about his marble, and how delighted he was to receive you at his house and show you his specimens. "We have marble all around us," he would say. "My property is full of marble, and the most beautiful marble in the world," yet in spite of the specimens, and in spite of a very strong financial backing, no profitable quarries have ever been worked on Mr. Baker's property, and Mr. Baker is now dead.

In starting a marble quarry do not depend too much upon the condition of the deposit as shown by the core. Get the judgment of an experienced quarryman, not one whose experience has been confined to one or two localities, but a man possessing general information on the subject, and whose experience has taken him to different deposits in different sections of the country. The judgment of such a man is of more value than a diamond drill, but it is very well to have both.

Do not spend money in the erection of a mill until you have demonstrated the fact that you have a quarry that will produce sound and profitable stone. In the Baker case hereinbefore cited, a handsome mill was erected in anticipation of the large business from the quarries, and though the mill has been operated almost since its erection, yet it has been supplied with marble from other localities, and is entirely out of place in its present situation. The prudent quarryman will send his product to the nearest mill, and pay for its sawing until he has proved that his quarry will produce sound material, and that he has located in the best place. When he decides to put up a mill he takes into consideration the most favourable point for power, for sand and water, endeavouring at the same time to keep the mill as near his quarry as possible.

Less than ten years ago it was the usual thing for men to spend from \$50,000 to \$75,000 on a quarry deposit before receiving returns. Recent improvements in quarrying machinery have largely reduced the cost of opening a quarry. It is a matter of record that a quarry opened within recent years at Gouverneur, N. Y., by Messrs. Davidson & Sons, of Chicago, paid for itself in about two months' time. The case was somewhat exceptional, though by no means extraordinary. Messrs. Davidson & Sons exercised prudence and discretion, not only in the selection of the site, but in the equipment. Instead of "plunging" into the quarry business with a sounding of trumpets and beating of drums, and buying an expensive plant of machinery, they took the sensible course to feel their way gradually. They purchased only such machinery as would be best suited for making an opening, having since gradually enlarged the plant.

A complete and thoroughly first-class plant of machinery for starting a dimension stone quarry, comprising derricks, hoisting machinery, channelling machines, rock drills, boilers, pumps, pipe, blacksmith's tools and fit-

tings, will cost about eight thousand dollars; but it is not necessary to spend even this sum of money unless the quarry has been operated before, or the proprietors are perfectly sure of the stone. If it is only a deposit which promises well, a first-class equipment can be procured for about thirty-five hundred dollars, one sufficient to do considerable work and serve every purpose for several months. Such a plant as this would comprise a channelling machine, drill mounted in a proper way to suit the work, boiler, pump, derrick and hoisting apparatus. The derrick should be erected with a view of using it for heavy lifting with a single line. In other words, it would be a derrick for power hoisting, though it is seldom necessary to do any power hoisting when starting a quarry. A great deal of work must be done in connection with stripping and general levelling off, then the channels must be cut, and in all this there is not much hoisting to be done in proportion to the other work. I have known quarries so situated on the side of a hill that practically no hoisting was done for at least a year, and in all that time the work was progressing favorably and profitably. A steam hoist is an expensive apparatus in the first cost, but a very valuable one, provided there is plenty of stone in the quarry to be lifted. In other words, it is an appliance which will only pay when there is enough work to keep it busy, otherwise it is cheaper to hoist by water power, or even hand power. A horse-power hoist is a useful apparatus in connection with quarry opening, and will usually serve the purpose of doing all the hoisting which is required until the quarry has progressed so far that the nature of the stone is well understood. A horse-power hoist is cheap in the first cost, and cheap in maintenance and operating expenses, and if properly constructed it will do a great deal of work. When the quarry begins to produce profitable stone a steam hoist may be put in and operated with the same derrick, while the horse-power hoist will always be useful, either at the loading station or at some other point about the quarry.

It is not good judgment to erect bricked-in or stationary boilers in starting a quarry, but those of the portable pattern mounted on skids are preferable. They may be placed near the work and can be moved about in case it is necessary. In other words, do not put in a bricked-in boiler until the steam hoist is put in, then it is best to put the boiler and hoist under one roof, and in this case a return flue tubular boiler is preferable. The boiler will serve to run the hoist and do other work about the quarry, while the portable boiler will remain in the quarry to run the channelling machines, drills, etc.

Florida Phosphates.

Messrs. Couper, Millar & Company, London, in a recent circular to the trade, give the following expression of their views on the question of Florida as a new phosphate producer:—

"There have been so many wild rumors scattered broadcast as to the newly discovered phosphate fields in Florida, that we feel it a pleasure to be able to give some definite information on this subject. We may mention that one of the members of our firm was in Florida last autumn, and since then we have been in constant communication with several reliable local correspondents. In addition to this we sent out a well-known phosphate expert, who spent two months in examining various tracts of land and, after his return, we had a further examination made of all the lands at present being worked. We may say at once that this is certainly the largest known deposit of phosphate, but there is nothing in this fact to substantiate the exaggerated reports as to analysis, etc. There are still many millions of tons of phosphate left in South Carolina, while the northern departments of France contain also quantities which can only be counted by millions. It is not the fact of the existence of so many millions of tons, but it is the rate of production and quality which really concerns the market. It may, therefore, be interesting to mention the following fact, viz., that shipments of Florida phosphate in January, February, March, April, 1889, amounted to 4,574 tons, and in the same four months of this year 5,745 tons were shipped, which does not show an extremely rapid rate of progress. It will take time, and more time than many people seem to think, to get these deposits into working order, as many of them have difficulties to contend with in the way of selection and separation of qualities and transport. Added to this, the rainy season has just commenced and will not give any assistance in the matter. Lands have been bought by the tens of thousands of acres, and in several instances as many as 10,000 acres have been bought in one section in order to secure 100 acres of good phosphate land. Many of the tracts acquired are 20 miles or more distant from the railway, and as the companies will not build branches unless guaranteed certain annual quantities the proprietors have been offering large quantities on the European market, so that if they manage to get a house here take such a contract they can then go to the railroad

companies and get a branch built, and borrow money from bankers to commence operations upon.

"Speaking generally it appears that the whole of the West Coast of Florida, from Punta Gorda to Tallahassee, is more or less underlaid with phosphate, but the test of the great bulk of this rocky stratum is below 50 per cent. This fact was ascertained several years ago. Recent exploration, however, in Citrus, Marion and Polk Counties has proved the existence of beds of much higher test. There are two kinds of phosphate, *i.e.*, the Rock and the Nodule formation; and as far as we can judge it is the deposits that contain the Nodules that are likely to prove the most important, for the test varies between 65 and 78 per cent., whereas the Rock phosphate runs down from 80 per cent. to 20 per cent., is more difficult to extract, and when extracted is difficult to classify. When the first shipments were being made whole car-loads on which heavy railroad freight had been paid were thrown aside on arrival at the port as being valueless, and it is only picked cargoes that have been shipped so far. This points to the conclusion that cargoes of really high test will be few and far between, the bulk testing about 65 to 70 per cent. We know one large tract of land which has an inexhaustible supply of this test. Difficulties have also arisen as to the titles under which some of the American companies have been working.

"Our conclusion, therefore, is that though Florida will be the largest producer of phosphate in the future, the quantities likely to be shipped for some time to come will not be large enough to affect the market, and manufacturers who rely upon these supplies for this year or early next year, are likely to be disappointed, everything pointing to present prices being maintained for some time to come."

A New Method of Preparing Manganese.

A new method of preparing manganese, by which the metal can be obtained in a few minutes in tolerably large quantities, and almost perfectly pure, is described by Dr. Glatzel, of Breslau, in the current number of the *Berichte*. A quantity of manganous chloride is dehydrated by ignition in a porcelain dish, and the pulverized anhydrous salt afterwards, intimately mixed with twice its weight of well dried potassium chloride. The mixture is then closely packed into a hessian crucible, and fused in a furnace at the lowest possible temperature, not sufficient to volatilize either of the chlorides. A quantity of metallic magnesium is then introduced in small portions at a time, the total quantity necessary being about a sixth of the weight of the manganous chloride employed. Provided that the crucible has not been heated too much above the melting point of the mixture of chlorides, the action is regular, the magnesium dissolving with merely a slight hissing. If, however, the mixture has been heated till vapors have begun to make their appearance, the reaction is extremely violent. It is, therefore, best to allow the contents of the crucible, after fusion, to cool down to a low, red heat, when the introduction of the magnesium is perfectly safe. When all the action has ceased, the contents of the crucible are again heated strongly, and afterwards allowed to cool until the furnace has become quite cold. On breaking the crucible, all the potassium chloride is found to have been volatilized, leaving a regulus of metallic manganese, fused together in a solid block, about three parts of weight being obtained for every two parts of magnesium added. The metal, as thus obtained, is readily broken up by hammering into fragments of a whitish-gray color, possessing a bright metallic lustre. The lustre may be preserved for months in stoppered glass vessels; but when exposed to air the fresh surface becomes rapidly brown. The metal is so hard that the best files are incapable of making any impression upon it. It is so freely magnetic that a powerful horse-shoe magnet, capable of readily lifting a kilogramme of iron, has no appreciable effect upon the smallest fragment. It was noticed that the introduction of a small quantity of silica rendered the manganese still more brittle, and caused it to present a conchoidal fracture, that of pure manganese being uneven. The specific gravity of the metal, former determinations of which have been very varied, was found to be 7.3921 at 22° C. This number, which was obtained with a very pure preparation, is about the mean of the previous determinations. Dilute mineral acids readily dissolve the pulverized metal, leaving a mere trace of insoluble impurity. It is also satisfactory that practically no magnesium is retained alloyed with the manganese, and the introduction of carbon is altogether avoided by the use of this convenient method.—*Kuhlrow*.

The property of the Ontario Mining Company, near Rat Portage, now being worked under an agreement with the Canadian Pacific Mining and Prospecting Company, is being developed under the superintendence of an English expert. Shaft-houses and other buildings are being erected, machinery introduced, and mining operations will be pushed to the fullest extent.

MINING NOTES.

Nova Scotia.

(From Our Own Correspondent.)

Pictou County.

At the Vale colliery the McBean seam is still shut down from the effects of the fire last December. The six-foot seam re-opened in January has been working fairly steady. The management has, we understand, secured a contract to supply 40,000 tons of coal to the I.C.R.

Mr. John Muir, who has leased what is known as the Kirby area, situated at a point between New Glasgow and the Vale colliery, is working on a four-foot seam of very fine coal. The situation of his property, however, places him at some disadvantage, as he has to haul his coal by road into New Glasgow at a cost of something like 50 cents per ton.

Under the able direction of Mr. Poole and Mr. J. G. Rutherford the old Foord pit, which has been idle since the disastrous explosion in 1873, is slowly being re-opened, and it is expected that early next year will be producing coal in quantity again. The seam here is the largest in the province, and of excellent quality for coking purposes. The Douglas slope, which is in the third seam, has been re-timbered and cleaned up, and drifts are being driven across the measures to catch the second seam which overlies them. The management will then be able to take the Cage pit seam out through the Douglas seam.

The MacGregor pit is working steadily. Some difficult pillar work along the creep has been successfully accomplished. The slants have been sunk to a depth of some 600 feet, and levels are being extended east and west. This seam gives a very good coking coal. There has been a great deal of repairing and fixing up done at this mine for the last couple of years, but it is now evident that all difficulties will soon be overcome, and that a large quantity of coal will be raised.

The Drummond colliery, under the direction of Mr. C. Fergie, is making steady and satisfactory progress. I am informed that they are raising 1,225 boxes per day (of 9h. 25 min.). These boxes hold from 14 to 15 cwt. of coal. Work has been resumed on the Scott pit seam. Altogether it may be safely stated that the output from this mine will be largely in excess of former years.

The main slope at the Acadia colliery is now down to a depth of 3,600 feet. These extensive workings entail constant care and watchfulness on the part of the management, and a large amount of time and labor is expended in looking after the roof and sides. Mr. Maxwell is introducing a new system of winning coal in the deep workings.

The Black Diamond, under the management of Mr. J. W. Sutherland is now raising about 175 tons per day. The coal is mainly used for local consumption. With a view to proving the underlying measures, a portion of this property is being prospected with the diamond drill, under direction of Mr. John Douglas, formerly underground manager of the Albion mines. The drill is now down to a depth of 240 feet, having passed through the Scott pit seam at 100 feet, and it is expected to cut the third seam at 360 feet, and the fourth, or McGregor seam, at a depth of 640 feet.

Gold Mining Supplies.

The principal depot in Nova Scotia, carrying the most complete assortment of first class goods, is

H. H. FULLER & CO'S
41 to 45 Upper Water St., Halifax, N.S.

Our line comprises Explosives, Fuse, American and English Mill and Hammer Steel, Bar and Bolt Iron, Steel Wire Hoisting Rope, Hemp and Manilla Rope, Rubber and Leather Belting, Miners' Candles, Oils and Lamps, Miners' Tools, Machinists' Tools, Blacksmiths' Tools, and every requisite for the gold miner.

H. H. FULLER & CO.,

Halifax, N.S.

Cumberland County.

Steady work is being done at the Joggins mines, about 200 tons being the average daily output at present.

The Minudie mine is idle.

Mr. Hall, formerly underground manager at Springhill, is reported to have discovered a promising four-foot seam at Salt Springs, Cumberland County, on which, with a small force, he is at present working.

The Lawson mine continues to turn out a small output for local trade.

(From Press Committee Gold Miner's Association.)

Central Rawdon District.

The June yield of the Central Rawdon Company, Mr. Gould Northup, Manager, was 543 ozs. The tons crushed were 100 of alluvial and 80 of quartz.

The yield of the Northup Mining Company, Mr. C. E. Willis, was 132 ounces from 155 tons.

Rawdon District.

Mr. Robert McNaughton has repurchased the property formerly sold by him to the English Company, and has commenced to pump out the water in the eastern end of the property. It is his intention to re-open the mine as soon as practicable and put it on a producing basis.

Waverley District.

Mr. MacDuff, Manager of the Nova Scotia Syndicate, Ltd., has about completed the work of straightening the shaft on the Union Lode and of getting the underground workings into proper shape for overhand stoping. A new gallows frame has been erected at the pithead, and systematic work has fairly been inaugurated.

The Lake View Mining Company are pushing the work on their stamp mill, and hope to have it stamping quartz before the 1st September. The company have from 1,000 to 2,000 tons of quartz stacked on the surface, and it is not intended to resume mining work until this accumulated quartz shall have been crushed and tested.

Oldham District.

Mr. T. P. Putman, on the 18th June, transferred the property of the Oldham Gold Company, bid in by him at public sale on the 10th June, to Messrs. Hardman & Taylor. Work was begun at once upon the Baker Vein, and No. 3 shaft is now sinking. It is calculated that intersections will be reached about 300 feet in depth, the shaft is now 268 feet. The June yield of the Standard Gold Company was 875½ ounces from 30½ tons.

Renfrew District.

The owners of the "Free Claim" property are rebuilding their stamp mill and water wheel gear. The old mill had been in use a long time, and was badly out of repair.

The Empress Company are working a few men only. The prospects are reported brighter than for some time past, but Manager Turnbull is wise in making haste slowly.

Killag District.

Mr. George W. Stuart started his mill on the 17th inst. on quartz coming from the new lode found last fall. Reports from this find are most encouraging, the width of the lode running from 8 to 16 inches in rolls, and is judged worth 2 ounces per ton.

Stormont District.

Mr. H. K. Fisher has about completed the organization of the North Star Company, operating the North Star group of mines on the west side of Isaac's Harbour. Mining is being vigorously carried on and the lode looks well. Early in July a prospecting drift from the main incline cut the rich streak worked years ago by former owners, and the quartz is variously estimated as worth from \$60 to \$100 per ton. The erection of a mill on the west side of the harbour is now under consideration.

In General.

The next regular meeting of the Gold Miners' Association will be held in the Halifax Hotel, Halifax, on Saturday afternoon the 2nd inst. at 2:30 P.M. A large attendance of members is particularly requested, important business being before this meeting.

Quebec.

We regret to learn of the death of Mr. S. B. Jenckes, President of the Jenckes Machine Company, of Sherbrooke. Mr. Jenckes was one of the early pioneers of our manufacturing interests in this province, having emigrated to Sherbrooke from Rhode Island in 1845.

Eastern Townships District.

From the pits of the United Asbestos Company, under the direction of Mr. John J. Penhale, a very nice quality of asbestos, of which a goodly portion was No. 1 quality, was turned out last month.

The Anglo Canadian has the crusher at work, and find it giving good satisfaction. By means of this machine they are now enabled to work up and utilize at a small cost, rock containing small veins, which formerly it did not pay to cobb by hand. The system adopted is similar to that formerly carried on by the Scottish-Canadian Company; 143 tons were dressed by the machine last month. Mr. Hopper is well pleased with the turn-out from all his pits.

The output from the asbestos mines in the Black Lake district for the month of June exceeded previous records for any one month's work since operations were begun here. All the mines did very well, and the production from some was exceptionally good.

The American Asbestos Company, under the able management of Mr. Klein, continues to push work with customary vigor. The new hoisting plant is in position on the top of the hill, and is run by compressed air from the compressor at bottom, the air being conveyed in pipes, a distance of some 1,800 feet or more; there is not an elbow in the entire line, thus lessening friction, there being only a difference of about 2 lbs. in the pressure on the hill and in the engine-room. The productiveness of the property is evidenced by the excellence of their last month's output.

Dr. James Reed is working on his Lot adjoining the Bell, or Hayden property. Several pits yielding good quality have been opened, and give excellent promise for the future.

The Laurier Mining Company has suspended work on the Lot adjoining the Anglo-Canadian property. Operations are entirely confined to some prospecting on the old Johnston & Loomis property.

The St. Julie Company has also been compelled to suspend operations; the quantity and quality of asbestos found was insufficient to meet prospecting expenses or to warrant a continuance of work.

The D'Israeli Company has shared a similar fate.

Good reports occasionally reach your correspondent from the Central Company, operating a property across the Lake.

Since writing the above, this district has been pretty well shaken up with an explosion of dualin. During a very severe thunderstorm the powderhouse of the Anglo-Canadian Company was struck by lightning, exploding with terrific force, some 30 cases of dualin and a number of kegs of black powder. Fortunately only one person was seriously injured, but the buildings in and about the place were all more or less damaged—but not to the extent of \$40,000 as reported by some Montreal papers.

Mr. A. M. Evans, M.E., of the firm of Blakemore & Evans, Cardiff, Wales, has been spending a few days in this district.

Messrs. King Bros. have at present about 180 men, under charge of Mr. Wm. King, operating some 6 pits south of the railway. Mr. King estimates that the production from his property will show a satisfactory increase over the excellent outputs of former years. Several openings on their property near Black Lake station have proved sufficiently encouraging to cause the erection of sheds and the construction of a road into the works.

The output from the Bell's Asbestos Company's properties continues up to the average, indeed Mr. Sheridan is confident that his output of 1,600 tons for last year, will be exceeded this season by close upon a thousand tons. About 200 men are employed.

Work is also going on briskly at the properties of the Johnson's Company, the Thetford Mining Company, and other Thetford mines.

The White's Asbestos Company has a force of men under Mr. L. Boyd working at Coleraine under agreement with the Megantic Mining Company.

Ottawa Valley.

The output of phosphate from the pits of the Phosphate of Lime Company at High Rock shows a slight lead over the production for the same period last year.

Mr. O. M. Harris reports that all the pits of the Canadian Phosphate Company are turning out satisfactorily. Through a typographical error Messrs. Millar & Company's ocean shipments were credited to Messrs. Wilson & Green and *vice versa*.

The North Star, Central Lake, Emerald, Aetna Hill and other phosphate mines on the Lievres River are steadily working and producing in good quantity.

Recent developments made in Lots 27 and 28 in the 4th Range of Portland West have proved extremely gratifying to the owners, extensive bodies of red and green apatite of high grade having been uncovered. Mr. John Haycock and a small force are at present engaged in the work. The property was recently visited by Mr. O. Ladureau, Directeur du Laboratoire, Central Agricole, Paris, in company with Mr. J. Obalski, M.E. Inspector of Mines for the Province. These gentlemen are unstinted in their praise of the extent and richness of the deposits revealed in these recent workings.

Mr. Robert Dollar, Fort Cologne, has a number of men prospecting over his property in the 4th and 5th Ranges of the Township of Wakefield.

All the Templeton mines are also doing well.

Messrs. Lomer, Rohr & Co., Montreal, made on 23rd inst. an additional shipment of 100 tons of felspar from the mines of the B. & C. Mica and Mining Company at Villeneuve.

From returns kindly furnished by Col. Lay, United States Consul General at Ottawa, we find that the exports of iron ore from 1st January to date, from the Bristol Iron Mines, have been 6,537 tons. The points to which the ore has been shipped are:—

To Catasqua, Penn. (previously reported).....	4,197 tons
“ “ “ (reported to date).....	2,202
“ Philadelphia, Pa.....	138

Iron ore, tons.....6,537

Ontario.

The Silver Center Mining Company of Ontario is the name of a new mining company incorporated by S. C. Duncan-Clark, John Flett, Henry Lowndes, Robert McClain, Richard Chaddick, Thomas Claxton, George Dunstan, O. A. Shaw, O. A. Howland, S. J. Dawson, M.P., and Ed. Gordon, to acquire, hold, lease, exchange and sell mining lands, consisting of mining location "R64," in the Township of Lybster, District of Thunder Bay, and other locations in the district, and to develop the said lands by working mines, smelters, stamping mills and other necessary works. The capital stock is \$300,000.

The Frontenac Phosphate Company (Limited) has been registered with a capital of £10,000, in £1 shares, to acquire phosphate and other lands and mines in Canada or elsewhere, and for such purpose to adopt an unregistered agreement with the Stirling Phosphate and Mining Company of Kingston (Limited), and with C. J. R. Stirling.

An important meeting of the Provincial Natural Gas and Fuel Company of Ontario took place in Toronto a few days ago, at which all the stock of the company was represented. The general manager reported that a new well of a capacity of 3,000,000 cubic feet per day had been added very recently to the already long list of successful wells of the company, the total production of these wells being now about 12,000,000 cubic feet per day more than what will be required to supply St. Catharines, Thorold, Merriton, Welland and adjacent places. It was decided to at once proceed to pipe these towns, as well as to run a pipe line to Buffalo to dispose of the surplus of gas. Offers from the best and largest pipe firms in the United States were submitted in person by their representatives to the directors, who have these various tenders under consideration. No doubt now that the first natural gas pipe line in this country will be an accomplished fact within the next few months.

The Imperial Oil Company and the American Company are steadily getting ready for the fall trade, which, by the way, will soon be upon us. The former company (the Imperial) are making some very extensive additions to their paraffin plant in the shape of three large brick buildings intended for the manufacture of paraffine candles, etc. The American Company have the brickwork about ready for their new stills, and are having a general all-round clean-up about their premises, especially noticeable is the new system of drainage they are putting through their yard.

The Kingston Board of Trade are making efforts to obtain a display of the minerals of Frontenac, Leeds, Renfrew and adjacent counties at the Midland Fair, 1st to 6th September next.

The proposed cement industry at Kingston under Mr. Linderoth has not materialized. He claims, by means of his patented invention of the mixture of sawdust with the raw material before calcination, that he secures more perfect formation of silicates, less free lime, and consequently strong cement. A new project is promoted in the limestone city by Mr. Strathy for the manufacture of builders' plaster, the plant for which, with little additional cost will, it is said, turn out Portland cement. A large cement plant at Marlbank on the Muban and Tamworth railroad is talked of. The extent of the marl deposits of Ontario is beyond estimate, and it is not unlikely they may yet be exploited to a considerable extent in the manufacture of lime as well as cement. Meanwhile the inventors, who are turning blast-furnace slag to every conceivable use, are likely to seek a market in this country for their cheap slag cement. It is a problem whether the leading brands of the best English Portland cement will be displaced by the weaker and cheaper cements now pressing on the market. The room for new competitors seems to be "at the top."

Port Arthur District.

(From Our Own Correspondent.)

THE BADGER SILVER MINING CO.—An exceedingly rich vein was discovered on the 2nd June running parallel with the old vein and situated about 350 feet south-west. It was exposed by running a cross-cut on bed rock across a break in the hill under about 20 feet of clay and boulders. It was about one foot wide at the surface of the trap, carrying galena, pyrites and zinc blende; the gangue was composed of calc spar quartz and fluor spar. At a depth of about 1 foot, leaf silver in considerable quantities came in; at 10 feet it carried about 100 ounces of silver, and has steadily increased in width and richness as depth is attained. The shaft is now down 76 feet, 56 of which is on the vein. Seven and a half barrels of high grade shipping ore, averaging 3,500 ounces of silver to the ton, has been taken out, besides 40 tons of mill rock that averages 100 ounces to the ton. Two-thirds of the vein has been left standing in the shaft. The width of the vein for the last 35 feet is five feet; the silver is in the form of native and argentite, with some zinc blende carrying very high in silver. The silver is quite regularly disseminated throughout the vein, but the richest portion is on the foot wall. Drifts have been started both ways from the bottom of the shaft, besides an adit level has been started in to strike the shaft at that depth. This same vein has also been found on the south-west side of the hill, a distance of 1,650 feet from the discovery shaft carrying the same gangue and an equal amount of silver with the surface of the vein at the discovery shaft. This is believed to be the richest and best discovery ever made in the Port Arthur silver region, and when it is opened up it is expected that it will exceed in richness, size and grade of ore anything in the history of silver mining on this shore, as it is now known to extend for such a great length through the hill and is apparently quite uniform, and in all probability extends into the low lands, down over the slope towards Silver Creek. It will be thoroughly prospected throughout its entire length by Capt. Shear. The force of miners has been increased to 135. The mill is running full blast, and the output of the Badger may be expected to surpass anything in its already remarkable history as a producer. This company has bought the adjoining property (Porcupine) for \$50,000 cash, on which there are three strong veins, one of which is partially developed; about \$10,000 was spent on it and 20,000 ounces taken out. Three shafts are now at work on the bottom level of No. 3 vein, and its development will be vigorously pushed.

THE BEAVER MINING AND MILLING CO.—The owners of this property must be congratulated on the present condition of the mine. For the past two years they have devoted their entire energy to development work, and have not sought to take out any silver excepting what was encountered in the drifts and levels, everything else being left standing, and it may be safely said that thousands of tons of high grade ore is now in sight in the mine. Your correspondent had the pleasure of going through all the workings a short time ago. Ten slopes are now working, and fifteen more are ready for commencement as soon as the mills demand. They have 2,000 tons of mill rock on the dump that will average 100 ounces to the ton. The mill is running night and day and giving entire satisfaction. It started up on June 16th, and has been running on an old refuser dump, left since 1887, that has averaged 30 ounces to the ton. Capt. Hooper invented an improved slow motion vanner, over which he is running this low grade ore. The silver is in the form of light thin leaves of argentite. The Frue vanner motion was too fast to save the thin leaves of silver, but the new vanner is doing the work remarkably well, and will prove a great boon to producers of this class of ore. There is sufficient ore in sight in the mine and on the dump to keep the mill running constantly for 3 years. The July shipment will amount to \$30,000, and will be made in a few days.

THE SILVER ISLET CONSOLIDATED MINING AND LAND COMPANY.—Capt. Thos. H. Trethewey and Mr. H. S. Sibley have just returned from an expedition extending over thirty days examining the company's property. A force of miners were placed at work on the Edward's Island location, situated nine miles east of Silver Islet. They have struck a strong well-defined vein, carrying arsenical silver ore assaying 700 ounces of silver to the ton. The vein is about 20 inches wide, and heavily mineralized. They also brought in some magnificent specimens of black oxide of manganese from a vein they discovered on the company's property at Cape Gargantua. The vein is from 7 to 10 feet wide. The manganese is on both walls and distributed through the middle. It assays about 45%. The importance of this discovery is very great when taken in connection with the vast amount of high grade ores waiting to be developed in this district.

SHUNIAH WEACHU MINES CO.—A new vein running parallel with the old one has been discovered on this property. It is situated about 200 feet to the south; it is about 2 feet wide, and has a rich pay streak 12 inches in width. A force of men are at work on the new find; all the ore taken out of it is being barrelled for shipment. It is very high grade, composed of argentite and native silver. They have also opened up a large body of high grade ore in No. 2 level west and east from No. 4 shaft.

McKELLAR'S ISLAND.—The United States Barytes Company are operating a large deposit of baryta on this island. They shipped 1,000 tons to Buffalo, N.Y., on June 28th. This shipment will be followed by regular monthly shipments of from 1,000 to 2,000 tons. This deposit is said to be the largest and best quality known to exist on this continent.

Explorers are swarming over both the silver and iron districts, and reports of wonderful discoveries of both metals are being made daily, many of which have to be discounted when the actual facts become known. Well authenticated reports by experts competent to judge of the finds of iron on the Aticokan River go to show that the metal is there in almost unlimited quantities, and of the finest Bessemer quality, giving average assays of 67% and free from all impurities.

(Later Correspondence to the REVIEW.)

THE BADGER SILVER MINING COMPANY.—Another rich strike of bonanza ore has been made on this property at a point 2,000 feet west of No. 1 shaft. An adit level was run in on the course of No. 1 vein for 134 feet; a cross-cut was then started north and driven for 50 feet, when a well defined vein was encountered, striking a little north of east and west on the course of No. 1 vein and dipping to the south. The vein is two feet wide with a pay streak of about 14 inches. Only one shot had been put into it when your correspondent visited it, and about 200 pounds of ore were blown out that would average 600 to 700 ounces of silver to the ton of 2,000 pounds. It is the intention of Supt. Shear to drift on this vein at once from the point of discovery, and also drive the lower level in No. 1 shaft on through the mountain. The vein is four feet wide at the breast of this level, carrying good milling ore averaging 40 ounces to the ton; when the length of this vein is taken into consideration the amount of ground to be opened on it is enormous.

The east and west levels at No. 2 vein are each in respectively 60 and 70 feet. The vein is carrying its width steadily, and the quality of ore is the same as that taken out of the shaft. In the adit started in to intersect the shaft at a depth of 76 feet the vein was encountered at the contact of the clay and rock. It is 3 feet wide, and stood up in a comb-like form in the clay. It is carrying 100 ounces of silver to the ton, and getting richer as they approach the shaft. It is only six weeks since this vein was discovered; 12½ barrels of high grade shipping ore has been taken out of it that will average 3,500 ounces to the ton, besides 250 tons of milling ore that will run all the way from 35 to 100 ounces of silver to the ton. I do not think that there is a better showing anywhere in America than there is on this vein for the amount of time and money expended on it. From where it outcrops on the west side of the hill to the point of discovery in the adit it is about 2,200 feet, and at every point where it has been opened it carries high grade ore. It is safe to say that they have 3,000 feet of this vein on their property.

No. 3 (Porcupine) vein sinking in No. 3 shaft and drifting in No. adit level is being proceeded with. The shaft will be sunk deep enough to intersect the adit, which will be 810 feet in length; it is now in 210. The ore being taken out of the shaft assays 125 ounces to the ton and out of the adit 100 ounces. The mill is running on No. 3 ore, and is treating 35 tons daily, the Krause Atmospheric Stamp doing 20 tons, and the five-head battery of stamps 15 tons daily. Supt. Shear has just had a Krause separating table placed in position in the

mill. This a new invention, and the first one of the kind set up in Canada. There are three in operation in the United States. It is triangular in shape, about 8 feet across the head, and tapering to an apex. The length is 16 feet. It is very simple in construction, and is designed to have the same motion as a shovel in the hands of a miner washing ore. The writer had the pleasure of inspecting it at work for several hours, and it is apparently giving entire satisfaction. It separates the concentrates into different grades, the heavies coming over at the head and the lighter grades lower down the table. The water is supplied by a perforated tube running down the front of the table. Its capacity is 9½ tons of pulp direct from the head daily.

THE BEAVER MINING AND MILLING COMPANY.—

The mill is running night and day, treating 25 tons daily. They have not finished the old 1887 dump as yet, nor do they seem likely to for some time. They expected that only a portion of it was worth milling, but as they get into the pile its quality keeps up giving a steady run of 30 ounces to the ton. None of the high grade milling ore has been put through as yet, but I believe that some of the higher grade will shortly be run through with the old dump. The Beaver is in first-class condition in every respect. They have an immense amount of ground opened up; ten slopes are at work, and fifteen more can be started at any time. They have 23 barrels of concentrates on hand, assaying from \$500 to \$1,500 per ton, besides 300 barrels of high grade shipping ore.

A. Lougheed, P.L.S., has just returned after surveying 1,740 acres of iron lands on the Black Sturgeon River for Detroit capitalists. The deposits are 35 miles up the river from the Canadian Pacific Railway at Black Bay. Mr. Lougheed describes the ore as a hard red hematite assaying 64% metallic iron and free from impurities. The most northerly deposit is 1¼ miles in length, and has an average width of 200 feet. The next one south is about 1½ miles long, and an average width of 35 feet. The most southerly location is half a mile in length. No ore was found in place on this location, but large quantities of float ore of a high quality covered the ground. The locations contain respectively 1,000, 500 and 240 acres. The lands are well timbered with white pine, spruce and tamarac, and plentifully supplied with water by the Black Sturgeon River. Mr. Lougheed estimates that there is a sufficient quantity of ore in sight to warrant the building of a 50-mile railway. There is no capping of Jasper granite or otherwise excepting a slight covering of red gravel in places.

The country rock is a reddish slate. This property ought to prove very valuable owing to the short haul necessary to bring it to deep water, and taken in connection with the immense deposits of magnetic iron west of Port Arthur, and the carbonate of iron in the immediate vicinity of the town ought to bring about the erection of blast furnaces at Port Arthur at an early date.

Lake of the Woods.

Work on the reduction works at Rat Portage is at a standstill owing to the delay to the machinery, which is being held by the customs at Port Arthur. The Government passed an order-in-council exempting mining machinery not made in Canada free from duty, and the collector at Port Arthur claims that duty should be paid and then remitted if it came under the order. The company has been obliged to stop work awaiting the settlement of the question, and all the men were discharged last Wednesday. The collector referred the matter to the Department of Customs, and the minister has been considering (?) it for some months. The cessation of work has brought forth many strong terms against the dilatoriness of the Minister of Customs and the action of the Collector. The Board of Trade met Saturday evening to take some action, and the general desire is that the Winnipeg Board of Trade should assist in this matter, as it is as much to the interest of Winnipeg that this should be settled as to Rat Portage.

[On enquiry at the Department of Customs, the Hon. M. Bowell replied to the above dispatch as follows:— "The parties have been told that all mining machinery not made in Canada is free. This they have not established, and in addition claim free admission of machinery imported before the law was passed, though not in Bond.—Edit.]

The buildings of the Lake of the Woods Gold and Silver Reduction works at Rat Portage are fast assuming shape. In fact, the main building is about completed, and the foundation for the engine house, the furnace house and the laboratory is being laid, and they will be rushed along as fast as possible. As the works will, when completed, be one of the institutions of the country, a short description may not be uninteresting. The works are located just across the bay from the town, on a rocky promontory jutting out into the lake, on the south side of the C. P. R. track, and about 100

yards distant therefrom. The company owns $2\frac{1}{2}$ acres of land, which was purchased from the Hudson's Bay company. The building which is erected on this land is in main 115 feet long by 106 feet wide and 75 feet high, in all five stories. It stands on a ledge of solid native quartzite granite, and is built of heavy timber and well put together. The sum of \$2,000 so far has been expended on rock-work alone. This embraces the foundations of the main building, the boiler room, the furnace room and the laboratory. The company intend constructing 150 feet of wharfage to facilitate the handling of home ore, which dockage can be extended to 1,000 feet if necessary as the site is surrounded by water on three sides. These docks will afford ample storage for the ore to be brought in from the Lake of the Woods district. A switch is to be put in by the C.P.R. and ore beds to accommodate foreignores will be built. The ore bins will be situated 11 feet above the level of the top of the rock-breaker, and will be run in cars by gravity. The ore bins in the building will occupy the top stories, and will have a capacity of 210 tons. The ore from the dock will be brought in by a steel cable over a tramway and dumped directly into a rock-breaker, the cable being worked from the engine. The ore when dumped into the rock-breaker, will be reduced by it to the fineness of chestnuts and wheat grains, and will drop through the breaker into large steel buckets attached to an endless chain belt. The ore will be carried in these buckets to the bins, 40 feet above, having a capacity of 210 tons.

Manitoba and N.-W. Territories.

The Alberta Railway and Coal Company has let out contracts for the construction of a large number of miners' houses. The houses and lots are to be obtained by the employees from the company on the following terms: Cost of house and lot from five to six hundred dollars, on a rental purchase of \$12 a month at 6 per cent. per annum interest, the house and lot becoming the property of the employee when principal and interest are paid. The sinkers have got down to the coal in No. 2 shaft. The engine and boiler have arrived for the same. A large staff of carpenters are at work forming trestle work to connect with the shaft and for convenience in loading the railway cars and teams. A large quantity of stone has been quarried and hauled for the foundation of engine and boiler beds and houses of the shaft.

Local papers announce that an expert of extensive experience in coal mining—no name is mentioned—has offered to defray 10% of the cost of boring for coal at Medicine Hat. He is confident that excellent coal will be found in the immediate neighbourhood of the town.

British Columbia.

Development work on the claim of the Lillooet Hydraulic Mining Co. at Lillooet is being actively pushed. At the last "clean up," representing ten days' work for four men, \$175 was taken out, the running expenses being \$90.

At Fish Creek, which is reached from the C.P.R. a few miles east of Illecillewaet, development work has been carried on during the most of the past winter, and two tunnels have been driven at different levels, showing excellent veins of argentiferous galena.

At the Vancouver Enterprise mine on Cayuse Creek, a tunnel is being driven under contract to reach a supposed buried channel of the creek some 600 feet distant, where rich pay gravel is looked for. Rock has been, however, struck in the tunnel, and the work may prove more troublesome than was expected.

The Raney brothers are actively engaged in opening out a mine of magnetic iron ore on the west side of the North Arm of Burrard Inlet. There is, unfortunately, a large proportion of pyrite in the ore taken out so far, but it is hoped that by sinking ore will be found in quantity free from this deleterious admixture. There is said to be a fine deposit of clay on the same property.

Certificates of Incorporation have been granted to the Middle Creek Gold Mining (capital, \$5,000,000) and the North-Western Gold and Silver Mining Company (capital, \$1,000,000).

The Nanaimo Free Press says the last of the importation of coloured miners left the mines on Friday, and the colliery work is now done entirely by whites and Chinese. The recent find of an eight-foot seam of coal at the Union colliery is more than confirmed, for a second bore at 700 yards distant from the first bore also struck the seam, and a third bore at about equal further distance also struck the coal within 16 feet of the surface. This is looked upon as a nice strike, and secures the permanency of the Union mines.

Notice of application for Incorporation is given by the Crow's Bar Mining Company (Limited), capital \$25,000 in 5,000 shares of \$5. The trustees who shall have the management of the affairs of the company for the first three months are D. L. Beekingsale, S. Herbert, J. W. Hoone, J. Van Volkenburger, all of Vancouver. The company is formed to acquire and work for gold and other minerals.

A company of which Major Vaughan is the moving spirit is engaged in an active search for coal in the valley of the lower Fraser. By co-operating with the C.P.R. Co. they have secured the use of the Diamond Drill belonging to that company, and are now boring at Kanaka Creek, that site having been chosen on the advice of Dr. Lawson, as the most likely one to test the general question of the presence of coal in the valley of the lower Fraser.

There is some talk among the more enterprising inhabitants of Lillooet of placing a steam tug on the Fraser between Lytton and Lillooet, that portion of the river being navigable. With a Government subsidy and a mail contract such a venture could doubtless be made to pay, and could afford much easier access to that portion of the interior than is now possible, and would lead to more active mining developments in a really promising district.

Prospecting is active on Illecillewaet Mountain this year. A large number of claims have been taken up both in the vicinity of the C.P.R. and on the North Fork, and assessment and development work is being done on most of them. The Selkirk Mining Co. have let a contract for the completion of their lower adit, which it is calculated will strike their lead at a point about 200 feet farther than it has already been driven. No active mining has been done on the adjoining Maple Leaf claim, but the property has recently been carefully examined and reported upon for eastern capitalists by Dr. A. C. Lawson, and it is probable that further development work will be commenced at an early date to test the value of the claim more thoroughly.

The erection of the smelting furnace at Golden is progressing favorably. The dimensions of the buildings and style and make of plant are as follows: One building for offices and analytical laboratory, 20 x 30; one for roaster furnace, 70 x 80; one for 2 calcining furnaces and ore crusher, 53 x 53, with an additional shed for coke, 53 x 13; one ore house, 40 x 40; also a receiving platform, 90 x 76, close to a spur of the C.P.R., capable of accommodating 12 box cars. There will also be a shed for coal fuel, 20 x 40. These buildings will be composed of square timbers with shingled roofing, and the usual precautionary measures in case of fire. The most of the plant was manufactured by Fraser & Chalmers, of Chicago, Ill., and consists of one water jacket furnace, 7 x 10, with No. 4 blower, 33 x 72; and one Blake crusher, 14 x 24. The belt rolls and sample grinder, 5 feet 6 inches, power elevator and all casting for the calcining furnaces were also furnished by the American firm. The motive power will consist of one 30-horse power slide valve engine and tubular boiler, 12 feet long by 42 inches in diameter; these were manufactured in Toronto. The supply of water will be taken from the Kicking Horse, by means of a No. 6½ Knowles pump, capable of a volume of 150 gallons per minute. This plant is intended or adapted to treat ores of the sulphurous or argentiferous galena class, but will also reduce ores carrying a limited percentage of copper. These works are intended to treat about 40 tons of ore in 24 hours, and will employ a minimum of about 30 actual workmen, exclusive of supernumeraries, if kept running in full blast.

In order to further aid the development of the mineral wealth of the province, the following reduction of fees for assaying, to come into effect on the 1st prox., has been ordered by the Hon. John Robson, Minister of Mines: Tests of single samples for gold, silver, lead and copper to be made for \$1.50 each; when two or more samples are tested, the charge will be \$1 each, and for all other tests a proportionate reduction will be made.

The General Phosphate Corporation.—The *Times* correspondent at Ottawa, writing under date of 25th July, says: "I learn on the best authority that the majority of the phosphate lands of the Dominion have been bonded by the Canadian representatives of the Phosphate Trust for a period of two months, with the option of purchase at the end of that time." We need hardly inform our readers that the statement is as absurd as it is untrue.

We learn that Mr. J. Lanson Wills, who has been absent in Europe and South America for several months, has returned to Buckingham.

Coke Bricks for Furnace Linings.—At a recent meeting, in Dusseldorf, of the Society of German Iron Manufacturers, F. Burgess, of Gelsenkirchen, referring to the subject of furnace linings, said it was well known to those who had to do with blast furnaces that the hearth and bottom of a furnace are the parts which, so far, have been the least successful in performing the duty expected of them. Often, after a short time, only a few inches remain of a hearth that was 3 or 4 ft. thick when set in. Then streams of water must be played on to keep the hearth in any condition at all. The great inconveniences of this state of things need no emphasising. The cause of this quick destruction of refractory material lies clearly in the circumstance that the hot slag, which in most processes is now acid and now basic, dissolves the lining in the shortest time and carries it away as slag. An experiment will show that the best refractory stone of the most widely differing composition, when placed in a stream of slag, will be completely melted away in one to two hours. This fact determined me to look for a better material. Carbon suggested itself to me, because it is apparent in the blown-out furnaces that the best inner coating consists of small coke and graphite cemented with lime and slag, and in this case it is the carbon which has proved the refractory armour. In practice, also, it is well known that slag runs best in a bed of coal or coke ash. The first experiment, which in 1882, was to make a combination of coal, coke dust, graphite, &c., with clay, and to use it in the form of bricks. The firm of Dr. Otto & Co. furnished him with several samples of this brick, which were somewhat defective, as in the process of making the bricks the carbon had been partially burned out; but even these gave good results. It was not possible to patent this process in the metallurgy of Brundkerl. It is mentioned that the lead furnaces in the Harz region were lined with such a mixture of coke dust and clay. In 1885 there appeared a paper by A. Purcel, on ferro-manganese, in which it was stated that already for several years in La Voulte and Talmain, France, hearths and bottoms of graphite bricks had been used. The raw material was retort graphite of 1 to 2 per cent. ash, which, ground and burnt with tar, was then made into bricks and calcined. Part of the tar was caked, and burned the graphite into a hard and durable brick. Experiments were made with ground coke poor in ash, instead of graphite, and these experiments always gave good results. In 1885 furnace No. 2 was lined with this material. And the use of it, even with large production, has given satisfaction ever since. The cost of the bricks is about 100 marks per ton.

Improvements in the Manufacture of Copper.—The improvements in Copper smelting, by P. C. Gilchrist, relate to the separation of copper from impurities, more especially arsenic, antimony and tin. In roasting of white or pimple metal for the production of blister copper, in the treatment of metallic bottoms for the removal of arsenic and conversion into blister or into refined copper, and also in the toughening and refining of blister copper, reverberatory furnaces are used, lined with shrunk dolomite, magnesite, chrome iron ore or other basic or neutral lining by which means it is possible to maintain during the operation of refining a basic slag instead of the acid slag as hitherto. A purer product is thus obtained, together with a larger yield and increase output. It has been found that a suitable amount of lime to add when charging white metal containing 75 per cent. of copper, is from 2 to 3 cents per seven tons of white metal charged. The metal should be melted down slowly under air. Much less slag will be formed than is usual in sand-lined furnaces. A good heat should be kept on the furnace throughout the charge. It is often advantageous to add a few shovelfuls of lime to the slag shortly before tapping the charge. Care must be taken not to form too thick a slag or the operation will be retarded. It is often convenient to charge in also some copper oxides or slags, and to subject the surface of the latter to the action of an air blast, the oxidising action of which materially assists the diminution of the arsenic. The object of the smelter should be to obtain as little slag as possible, and with a low percentage of copper in it, skimmings of slag should be made three or four times, as desirable. When the sample begins to show a blister fracture a few shovelfuls of lime are to be added once or twice until the bath is ready for tapping. The slags obtained when working as described will not average more than 30 per cent. of copper, whereas when working with the ordinary sand bottom the slag usually averages 55 per cent. of copper, besides weighing considerably more per ton of blister produced. It was found when treating 400 tons of metallic bottoms in a basic lined furnace that there was obtained 323 tons of blister and 107 tons of slag, averaging 25 per cent. of copper, and that when treating an equal weight of metallic bottoms in a sand-lined furnace there was obtained 191 tons of blister only and 221 tons of slag, averaging 55 per cent. of copper. A slag in which there is no more silica than 20 per cent. should be worked with, as with more siliceous slags the elimination of the impurities takes place more slowly. —*Journ. Soc. Chem. Ind.*

The Davis-Colby Ore-Roaster *

By Sterling G. Valentine, Ph.D., Lebanon, Pa.

The annual use of large quantities of sulphurous iron-ores (over 1,500,000 tons in the United States) has led to a search for the best methods of desulphurization, in order to make this material more available for the manufacture of a good quality of pig-iron. Although such ores can be used raw in small amounts, they must be previously roasted if they are to constitute the entire ore-charge of a furnace.

In a former paper some of the chief conditions necessary to satisfactory roasting of ore were examined on the basis of experimental data. They indicated, too, the most prominent characteristics of a good kiln. It is proposed to give in this paper some description of the latest application of a gas fired roaster to the preparation

of sulphurous ores, as exhibited in the Davis-Colby kiln, including a statement of some results already obtained in actual practice. The principles involved in the construction and work of this roaster cover the most prominent points heretofore shown to be necessary for good results.

The Davis-Colby ore-roaster is the outcome of some years of trial and practical experience. In the years 1878-9 the Katahdin Iron Works built at their furnace a Westman kiln, which was fired with wood, for the purpose of making the ore used there available for the manufacture of charcoal car-wheel iron. The ore at that locality is a hematite, resulting from the oxidation of a ledge or vein of pyrites, and carries a good deal of sulphur. The Westman kiln being in many points unsatisfactory, changes made from time to time to secure increased efficiency resulted in what is now known as the Davis-Colby gas-fired roaster. This has been and is yet

in constant use at the Katahdin Iron Works, and kilns of the same type have been since introduced at other points.

The illustrations, reduced from drawings kindly furnished by Mr. A. G. Davis, will give a clear idea of the construction of the kiln. In general it consists of two concentric shafts of brick-work, enclosing between them an annular space, *E*, 18 to 24 inches in section, to contain the ore under treatment. The inner shaft, *F*, is continued to a proper height above the top of the roaster to form the draft-stack, as shown in Plate II.; or it may be covered, as in Plate I., the products of combustion being carried downward and out through the flue, *F'*, to a separate chimney. This would allow of any utilization of the fumes deemed expedient. A cone-covered top, as shown, permits of more convenient charging, as ore can be dropped from car-hoppers upon the cap, *L*, giving an even distribution of the ore. In the outer wall are

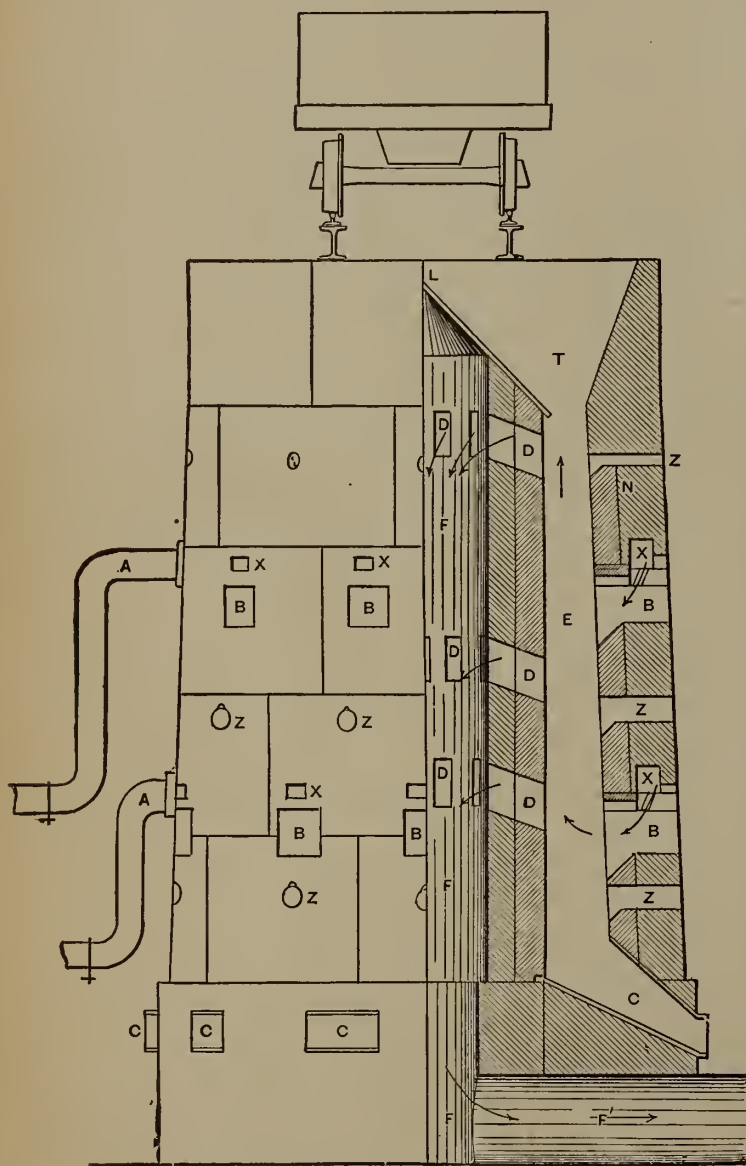


FIG. 1.—Down Draft Davis-Colby Ore-Roaster.
(Scale: $\frac{3}{16}$ inch to 1 foot.)

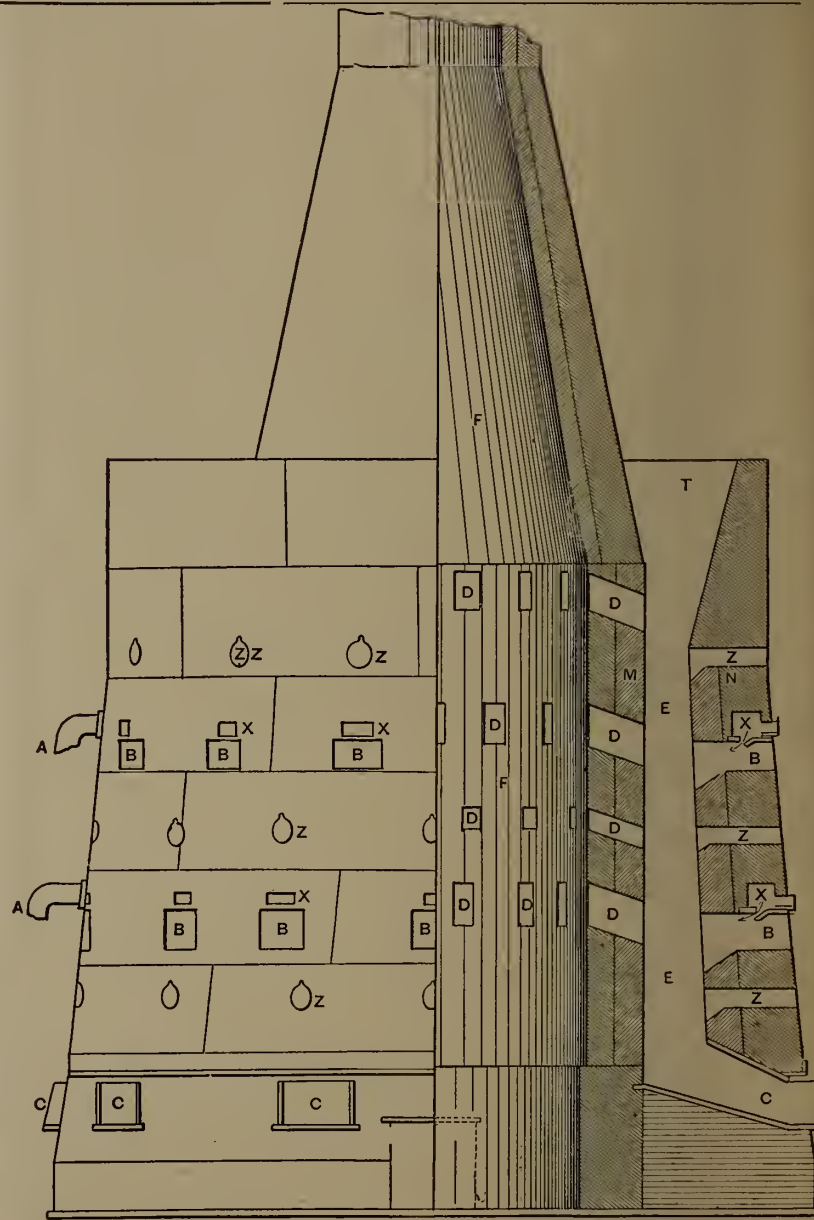


Fig. 2.—Davis-Colby Ore-Roaster, Cornwall Anthracite Furnaces, Cornwall, Pa.
Scale: $\frac{3}{16}$ inch to 1 foot.

placed the chutes, *C*; the fire-arches, *B*; the gas-flues, *X*, and the poking-holes and air-holes, *Z*. Openings in the inner wall, *D*, admit the fumes and products of combustion to the draft-stack, *F*. These openings are placed higher or lower, according to necessities arising from the character of the ore under treatment. The external shape, as shown in Plates II. and III., is that of the Giers kilns, which were remodelled to the new type. These illustrations are given to show how readily the ordinary style of roaster may be adapted to this new design. In some cases, particularly where dense hard magnetites are to be roasted, the height of the kiln is increased above that shown, for the purpose of giving the ore a longer exposure to heat; and the fire-arches are put at a greater vertical distance apart, so that the ore may partially cool after its first heating, and be cracked or fissured, thereby exposing the remaining sulphur more thoroughly to the action at the second fire-arches. A

gallery around the outside, at the proper height, gives workmen convenient access to fire-arches and gas-flues.

Gas from the mains, *A*, enters the flues, *X*, in the outer wall, and is distributed to each of the fire-arches, *B*, flowing downward through the outlets, as indicated by the arrows. Two or more sets of fire-arches are used. In these the gas is burnt, the flame and heat impinging on the ore as it descends in the annular space, *E*, raising it to any temperature required. This heating is done in the presence of abundant air, entering at the chutes, *C*, the fire-doors, *B*, and the poking-holes, *Z*. After passing through the ore the air enters the draft-stack through the openings, *D*, carrying with it the gaseous products of combustion and sulphur oxides from the ore.

The ore is filled in at the top, *T*, passes down the space, *E*, which gradually widens downward, and is drawn below from the chutes. Its cross-section being so

narrow, the whole body of ore is thoroughly exposed to the fire.

At most places where these roasters have been introduced, the gas used for firing has been surplus gas from the blast-furnace. Where this supply is abundant and clean, or where the gas can be cleaned for introduction to the flues of the roaster, it answers very well, and is economical. Small blast furnaces can the better allow this method, as their surplus supply of gas is generally sufficient, and likely to contain a larger amount of combustible constituents than that from larger furnaces, the latter, as a rule, having little surplus gas above that required for hot ovens and boilers. But there are serious objections to depending on the use of furnace gas under the circumstances generally prevailing. The gas-flues and small openings into the fire-arches require to be kept open and free from dirt; and while this can, of course, be readily done, it increases the attention required in

working the kiln, and is so far an annoyance and disadvantage. The difficulty of getting a clean furnace-gas is an important objection to its use. Then, too, the variations in the quantity and quality of furnace gas are against it. When a furnace man is especially desirous of securing well-roasted ore, he may find such fuel unequal to the task of preparing it. There are, after all, few furnaces that afford gas enough to heat their blast, furnish their steam, and roast their ore at the same time. It is questionable economy to make any endeavour to turn a blast-furnace into a gas-producer. It may be desirable at times however, to use waste furnace-gas for whatever part of the work of roasting it may be equal to, and augment the supply from another source.

Producer-gas, therefore, is a preferable fuel for the roaster, and can be obtained cheaply from some such apparatus as the Taylor producer. With such an arrangement the gas supply can be kept uniform in quantity and

quality, or can be varied, as the case may demand, thus giving increased control of working.

The principles involved in the construction and working of the Davis-Colby roaster are well calculated to produce good results. The heat is under almost absolute control. Any set of fire-arches, or any single fire-arch, can have its supply of gas increased or diminished at will. The double set of fire-arches serves to keep the ore at the desired temperature until drawn into the chutes, so that from the first point of heat it is held, during its entire descent, at such a temperature as to make the action of atmospheric oxygen upon it most effective.

The air required for a proper oxidation of sulphides in roasting is furnished abundantly through the poking-holes, fire-doors and chutes, passing through the hot ore into the chimney. Thus, the hot ore is always exposed to an oxidizing atmosphere, and a prime requisite for good results is well attained. The narrowness of the ore-section has

well adapted to roasting. The following table shows its composition when raw :—

Raw Katahdin Ore.

	I.	II.	III.	IV.	V.
Iron	47.75	57.34	44.80	39.50	53.50
Phosphorus....	.017	.025	.04	.035	.034
Sulphur	3.90	1.29	.98	2.50	2.48

The roasted ore contains the following percentages of sulphur :—

	1	2	3	4	5	6
Per cent. Sulphur, -	0.07	0.15	0.10	0.18	0.12	0.10

The roasted ore runs, as a rule, from 0.05 to 0.20 per cent. of sulphur, averaging not over 0.10 to 0.12 per cent.

Cornwall, Pa., ore, containing on an average from 2½ to 3½ per cent. of sulphur, gives the following results when treated in Giers Kilns :—

Cornwall Ore Roasted in Giers Kilns.

Per cent. Total Sulphur.	Per cent. Sulphur as Sulphate.	Per cent. Sulphur as Sulphide.	Per cent. Total Sulphur as Sulphate.
1.133	0.283	0.850	24.977
1.380	0.135	1.245	9.782
1.873*	0.096	1.777	5.125
.800	.....	.....	.....
1.410	.....	.....	.....
1.050	.....	.....	.....
1.120	.....	.....	.....

The same ore roasted in the Davis-Colby kilns shows results as follows :—

Cornwall Ore Roasted in Davis-Colby Kilns.

Per cent. Total Sulphur.	Per cent. Sulphur as Sulphide.	Per cent. Sulphur as Sulphate.	Per cent. Total Sulphur as Sulphate.
0.577	.....	.....	.....
0.779	.....	.....	.....
0.674	.....	.....	.....
0.666*	0.533	0.133	19.96
0.602	0.497	0.105	17.44
0.398	.....	.....	.....
0.697	.....	.....	.....
0.782	0.358	0.424	54.21
0.798	0.480	0.318	39.85
0.596	0.315	0.281	49.14
0.740	0.534	0.206	27.83
0.850	.....	.....	.....

*Samples of clinkered ore.

As being of interest in this connection, the following results are given as obtained by another type of gas-fired roaster, the Taylor kiln, on magnetite ores from the Jones mine, Berks Co., Pa. This one is similar to Cornwall ore, and carries about the same amount of sulphur. The analyses are by Mr. R. H. Voudy, of the Phoenix Iron Company, and the roasting was done in their kiln :

"Jones" Ore Roasted in Taylor Kiln.

Per cent. Total Sulphur.	Per cent. Sulphur as Sulphide.	Per cent. Sulphur as Sulphate.	Per cent. Total Sulphur as Sulphate.
1.087	0.656	0.431	48.85
1.059	0.552	0.507	47.87
1.045	0.618	0.427	40.86
.912	0.548	0.364	39.91
.909	0.444	0.465	51.15

As to the ability of the Davis-Colby roaster to dispose of fine ore, it may be well to state that, when properly charged, as much as 30 to 40 per cent. of fine ore can be used. But fine and coarse should be thoroughly mixed in filling, as a solid mass of fine ore before a fire-arch chokes off the gas and prevents the heat and air from penetrating the ore. Kilns of the size shown in the illustrations, roast from 75 to 100 tons of a reasonably porous

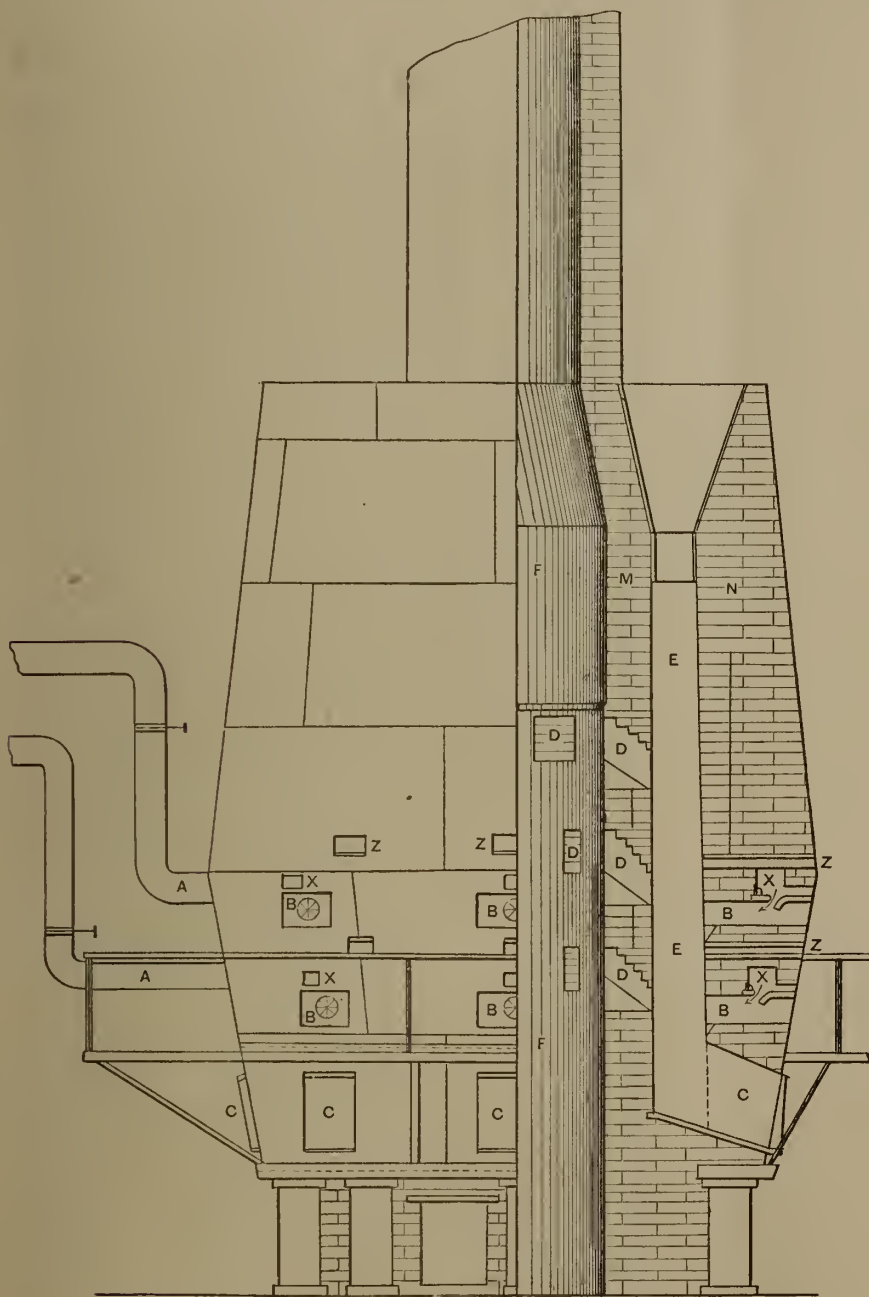


Fig. 3.—Davis-Colby Gre-Roaster, Colebrook Furnaces, Lebanon, Pa.
(Scale: $\frac{3}{16}$ inch to 1 inch.)

the advantage of making it very difficult for any ore to pass the two or more fire arches without being well exposed to oxidation. Since the openings into the draught chimney are just opposite, and a little above the fire-arches, the heat and air are drawn through the whole of the annular space, all gaseous products of consumption passing promptly into the stack and being removed.

Sulphur of iron can be decomposed by atmospheric oxygen alone at ordinary temperature, a very slow reaction indeed, but, like most chemical reactions, the process of oxidation is accelerated by heat. On the other hand, a high temperature, without oxygen, affects a partial decomposition of FeS_2 , leaving a compound very nearly FeS , volatilizing about half the sulphur, but cannot carry the process further alone.

Oxygen being present, however, the chemical affinity between it and sulphur is increased by heat, and a complete oxidation of all the sulphur is theoretically attainable. Oxygen is absolutely necessary for the removal of the second half of the sulphur. Heat is required in such a degree in each case as will most effectively enhance oxidation, and as long as it is desirable to continue the oxidizing action, the heat should be kept at the most favorable point, with ample opportunity for admission, at the same time, of atmospheric oxygen. It is this fact that brings out the peculiar effectiveness of the Davis-Colby roaster.

Some analyses are appended to show results obtained in actual practice with the Davis-Colby roaster.

Excellent results have been obtained in working on Katahdin, Me., ore, which is very open and porous, and

ore in twenty-four hours. Of course a hard, dense ore requires a longer exposure, and the output of such ore is somewhat less. The roaster at the Katahdin furnace, 20 feet high, and 15 feet in diameter, roasts about 40 tons per day, the entire supply for the furnace. The kilns at the Colebrook furnaces and Cornwall anthracite furnaces, as shown in the illustrations, roast from 75 to 90 tons of Cornwall ore per day.

The occurrence of clinkers in this roaster causes little difficulty in working. They are local, seldom extending beyond the bounds of one or two fire-arches, and as the annular space is so narrow, and widens downward, they are readily reached and broken up while hot. Indeed, with proper attention, there is no reason why clinkers should be allowed to form at all, owing to the easy and full control of the heat. But carelessness of men in charge will sometimes bring about that result. The upper fire-arches should generally be kept at a somewhat lower temperature than the second set, gradually raising the ore to the desired heat as it descends, so that if clinkering does take place it is only after long heating at a lower temperature, and after atmospheric oxygen has had full play on the reasonably hot ore. It is seldom necessary to sinter an ore in roasting, but if it is done, it should be the final act of the process, as it renders further effective roasting impossible.

The cost per ton of roasting ore in this kiln varies with the circumstances, and it is scarcely possible to give figures. The cost is greatly affected by the method of breaking and filling the ore, and by the use of furnace, or produce-gas.

New kilns, with a capacity of 75 to 100 tons per day, are built by contract for \$3,000, including royalty. But the system can be adapted to any ordinary Giers kiln, the expense varying with the size and shape of the original roaster.

It is possible that this roaster may find a new field of work in the preparation of gold and silver-bearing lead ores, and other metallurgical processes of which roasting forms a part.

* Transactions of the American Institute of Mining Engineers.
(Ottawa Meeting, October, 1889.)



Burk v. Tunstall.

This was an application for a writ of prohibition against George Tunstall to restrain him as Gold Commissioner for West Kootenay from further proceeding in an action brought in his court by Robert Burk to recover \$70 for labor performed in the Cariboo mining claim in Illecillewaet in the district of West Kootenay. The following is the verdict of the Supreme Court:—

"The grounds taken by Mr. Wilson in applying for rule nisi were that Mr. Tunstall is a gold commissioner appointed by the Provincial Government, and that the powers given to a gold commissioner sitting as a judge in a mining court under section 11. of the Mineral Act are *ultra vires*, to the Provincial Legislature, the power of the appointing judges being solely vested in the Governor-General.

"It is to be regretted that no argument was addressed to me in support of the powers claimed by the gold commissioner under the Act, as no one appeared in opposition to the rule.

"The sections of the Mineral Act, so far as they are of importance with reference to this application, are as follows:

"Sections 4 authorizes the Lieut.-Governor in council to appoint gold commissioners either for the whole province or for a particular district. Sec. 5 establishes in every district a court called the mining court over which the gold commissioners shall preside.

"Such mining court by sec. 6 is to have original jurisdiction as a court of law and enquiry to hear and determine all mining disputes, and is to be a court of record, and the gold commissioner is to have the same powers for enforcing the judgments or orders of his court as are exercised by the Supreme Court or a judge thereof.

"Sec. 10 gives a jurisdiction as to disputes relating to real estate held under the Act. Sec. 11 gives jurisdiction as to personal claims arising between persons engaged in mining, and in respect to supplies furnished to persons engaged in mining, and sec. 12 authorizes the gold commissioner to issue writs of *ca. re. ne exeat* and *ca. sa.* in all cases in which by law he has jurisdiction, which apparently means in all cases in which the Act clothes him with jurisdiction.

"We here find a very large and extended jurisdiction vested in the gold commissioner, unlimited as to amount, and limited only by the fact that the questions to be decided by him must be between persons engaged in mining or in respect of supplies furnished to persons engaged in

mining. This jurisdiction is in reality in excess of the powers vested in the County Courts, uncontrolled by any rules and unfettered by any restrictions. The issues that can be raised under these sections may involve property of a very great magnitude and questions of the greatest importance. In addition to these judicial powers the gold commissioner is vested with certain judicial functions respecting the recording of claims, defining of boundaries of claims, laying over claims, and other matters of considerable importance to a mining community, but which are not involved in the question now before me.

"Prior to Confederation the Provincial Government had all the necessary authority for establishing courts of this character and of appointing the presiding officers, and secs. 4, 5 and 6 were enacted prior to Confederation.

Since Confederation the Provincial Legislature has power to constitute, maintain and organize provincial courts, including procedure in civil matters, under section 92, sub-section 14 of the B. N. A. Act. So far then as that act establishes a mining court and creates its jurisdiction it was within the powers of the Colonial Legislature, but when the Provincial Legislature attempts to appoint judges of the courts thus constituted with other than ministerial powers, it trenches on the powers expressly given to the Governor-General by section 96 of the B. N. A. Act. It is true that the language used in that section is limited to the judges of the Superior, District and County Courts in each province, and it might be contended that these courts having been expressly named, all other courts are excluded. If this were so, the Provincial Legislature would only have to constitute a court by a special name to enable them to avoid this clause, but in the section itself after the special courts thus named, the courts of probate in Nova Scotia and New Brunswick are excepted from the operation of the clause. If these courts had not been so excepted the conclusion would naturally be that they would have been included within the terms under which the other courts are described.

"But there is a further view which I think is conclusive on this point. It is a prerogative of the Crown to appoint all judges, and such prerogative cannot be taken away except by express words, and this prerogative has been delegated to the Governor-General, and I see nothing in the Act taking this right away and vesting it in the Lieutenant-Governor. In the *Magdalene college* case, 11 reg. it was held that when the King had any prerogative, estate or interest, he shall not be barred of them by the general words of an Act of Parliament, and Lord Cairns in *Theberge v. Landey*, 2 app., cases 102, says their Lordships wish to state distinctly that they do not desire to imply any doubt whatever as to the general principle that the prerogative of the Crown could be taken away except by express word.

"I, therefore, hold that the power of appointing judges of the mining courts is vested in the Governor-General, and that although the appointment of a gold commissioner for certain purposes of a ministerial nature, which are defined in the Mineral Act, is entirely within the powers of the Provincial Legislature, yet to clothe that officer with the important and extensive judicial jurisdiction which section 11 of this Act purports to do, is entirely beyond the power of the Provincial Legislature.

"I may point out that under the 7th section of the Mineral Act, the County Court, if there is one whose jurisdiction extends over the district for which a gold commissioner is appointed, has exclusive jurisdiction in all mining questions under the Act, and it will be for the Government to make provision to meet the difficulty that has now arisen.

"I, therefore, direct that the rule for a prohibition be made absolute."

Prosecution Under the B. C. Coal Mines Regulations Act.—Mr. Francis D. Little, manager of the Union Colliery, Comox, was charged before the Magistrate's Court, Comox, on 20th inst., with a contravention of the Coal Mines Regulation Act, inasmuch as he did unlawfully employ a Chinaman named Cow, number 99, underground in said mine contrary to the provisions of the Act.

Mr. Archibald Dick, Inspector of Mines, prosecuted. Several witnesses were examined, whose evidence went to show that the man was a Chinaman and that he had been employed as charged. A second case was also proceeded with, the party being Toong, another Chinaman. Considerable discussion ensued as to whether or not the parties were Chinamen or could be considered as such, both of them being British subjects, Toong having been born in British Hong Kong, and, as he said, belonging to the British Queen, and not to the Chinese Emperor.

Mr. Luxton, after considerable argument, contended for the defence that the Act of the British Columbia Legislature was unconstitutional because it legislated on trade and commerce, interfered with the treaties between Great Britain and China, and legislated aliens as well as questions on criminal law, which were *ultra vires* beyond the power of the Legislature of British Columbia. He submitted that these cases showed conclusively that a statute which enacts words under which it is sought to

create an offence cannot be altered in its language for the purpose of including an offence in it, he claimed, therefore, that section 12 cannot be altered by the magistrate or any other court to include the words "or Chinaman" within its provisions, and without the insertion of these words the offence is not constituted by the Acts as committed by the defendants.

Section 95 of the Act which imposes the penalty says that "any person who is guilty of any offence under this Act, shall be liable, etc.," but neither section 12 nor any other section of the Act makes the employment of a Chinaman an offence under the Act, therefore no penalty could be imposed for so doing. The above is one of the objections I have against the Magistrate assuming jurisdiction in this case.

But even assuming for the purpose of argument, that the Magistrate has jurisdiction, expressly given by the Act, then I submit that no offence has been committed by defendant because the person named Cow in the information is not a "Chinaman" as he certainly has proved on his own testimony that he was born in Hong Kong, and if he was born there I submit he is a British subject.

The Magistrate asked—Is it not the question, of Chinamen or no Chinamen, and would not any Chinese person, even if he is a British subject, come within the prohibitory section of the Act.

Mr. Luxton replied—The question arises, "What is a Chinaman?" The prosecution here says that because Cow was born in Hong Kong, which is geographically in China, he is a Chinaman. I claim if a person is born of Chinese parents in British Columbia he is a British subject, the same as he would be if he was born in the British colony of Hong Kong.

The Magistrate—Is it not a question of Chinamen by race and not by nationality?

Mr. Luxton continued—The race of the Chinamen is the Mongolian race, and had the Legislature intended to restrict the employment of persons of the Mongolian race generally in coal mines, the words of the Act would have been instead of "and no Chinaman," the expression, "and no person of the Mongolian race." There is authority for the distinction in Legislative enactments in the usage of the Legislature of California where they legislate against the "Mongolian race," and not against Chinamen.

The Magistrate reviewed the arguments of Counsel, the conclusiveness of which he was bound to concede, so far as the want of jurisdiction of justices to entertain, hear or determine charges for the unlawful (because prohibited) employment of Chinamen in coal mines was concerned, but the Magistrate otherwise considered the facts alleged in the informations to be sufficiently proved, and it was only his want of jurisdiction that compelled him to refrain from convicting the defendant of the offences charged. The constitutional objections raised against the validity of the Act purporting to prohibit the employment of Chinese in coal mines, the Magistrate said he regarded as (practically) beyond his province to decide upon, therefore he should in any event have left it to be dealt with by a higher court.

He dismissed the charge in both cases, but without costs.

An English Syndicate Secures the Blake and Knowles Steam Pump Works.—An English syndicate has secured control of the Blake Steam Pump Manufacturing Company at East Cambridge, Mass., and the Knowles Steam Pump Works at Warren, in the same State.

This purchase differs in one respect at least from others which have been made recently by English capitalists. All the common stock of the corporation is retained by the old owners of the plants, only the debenture bonds and preference stock being offered for sale. The debenture bonds provide that out of the earnings of the company three per cent. of the amount of the bond issue shall be set aside each year to constitute a sinking fund. Each year three per cent. of the bonds will be drawn and paid off at a premium of ten per cent. The reason given for the deal is the fact that two of the largest stockholders in the old concerns, Messrs. Blake and Taylor, are anxious to be relieved of the care of business, the former on account of advanced age and the latter because of poor health.

A Big Natural Gas Pipe Line.—The *Pittsburgh Commercial Gazette* says that a natural gas line, 20 miles long, and costing in the neighborhood of half a million dollars, is to be built at once from the wells of the Carnegie Co., in Washington county, Pa., to the steel works of Carnegie, Phipps & Co., at Homestead. Mention was made in the columns of the *Gazette* a few days ago of the purchase by the Carnegie firm of 10,000 acres of gas lands in the county named. Some of the best gas land in that section were included in the sale, and it is to this field that the line mentioned above will be built. The placing of this contract, as well as the other large one made by the Philadelphia Co. for its new line to the Bellevue field a few days ago, indicates a big revival of the pipe-laying industry this year.

The Desulphurization of Pyritiferous Iron-Ores.*

By Sterling G. Valentine, PH.D., Lebanon, Pa.

Until within late years, the preparation of sulphurous ores for the blast-furnace has received comparatively little attention. After the first improvement made on the old style of heap-roasting and roasting between walls, there has followed an almost general adoption of the Giers kiln or some modification thereof, and the majority of iron-masters have seemed perfectly satisfied with so much progress. However, the Westman kiln was developed in Sweden, and other gas-roasters for sulphurous ores have been since constructed. They are in use on the continent of Europe and in America to a limited extent.

The following experiments were made in order to furnish additional information as to the proper conditions for the elimination of sulphur from ores where it is present as sulphide of iron, FeS_2 . I desire here to acknowledge the kindness of Dr. Franklin Menges, of the laboratory of Pennsylvania College, at Gettysburg, Pennsylvania, for lending his valuable aid in carrying out a part of these experiments and analyses.

In the first series of these experiments, pure, roughly-pulverized pyrites crystals were used, containing 53.42 per cent. of sulphur. They were made with a view to determine the effect on pyrites, of heat alone, in various degrees of intensity and duration, air being altogether excluded. The heats at a low temperature were made in glass combustion-tubes, sealed at the end, where the pyrites to be tested was placed, and with only a small opening at the opposite end. Although not allowing circulation, this arrangement still permitted a part of the evolved sulphur to escape. The heats at high temperatures were made in Hessian and graphite crucibles, tightly luted, every precaution being taken to exclude air. The temperatures attained are given approximately, and are as nearly correct as it was possible to estimate them, using Pouillet's scale as a guide.

The following table will show the effect of heating pyrites, FeS_2 , air being excluded:—

Approximate Temperature in Deg. Fahr.	Duration of Heat.	Sulphur in Residue, Per cent.	Loss.	Per cent of Total Sulphur Expelled.
Original Pyrites.....		53.425		
1250 " 45 min.		45.500	7.925	14.830
" 5 hrs.		42.591	10.834	20.270
1400 " 1 "		45.140	8.285	17.379
" 1 "		43.570	9.855	18.446
" 6 "		41.850	11.575	21.665
1600 " 30 min.		37.933	15.472	28.990
1800 " 1 hr.		39.389	14.036	26.272
2600 " 30 min.		29.519	23.906	44.720
" 45 "		31.519	21.906	41.003
" 1 1/4 hrs.		29.560	23.864	43.917

The residues from these heats had lost their metallic luster and were generally grayish in color, soft and friable. The samples heated at a white heat were, of course, completely fused. The figures show that, except in the case of a high heat, comparatively a small part of the sulphur was expelled by heat alone without access of air. Contrary to the idea generally prevalent, it is shown by these results that, while a part of the sulphur volatilizes readily, it is by no means easy to get rid of half of it if air is excluded.

The next experiments were undertaken to ascertain the effect of heat on FeS_2 when air is given access freely:

Approximate Temperature in Deg. Fahr.	Duration of Heat.	Sulphur in Residue, Per cent.	Loss.	Per cent of Total Sulphur Expelled.
Original Pyrites.....		53.425		
1250 " 1 hr.		4.271	49.154	92.050
" 2 1/4 hrs.		.700	52.725	98.680
1600 " 20 min.		.78	52.645	98.540
" 45 "		.08	53.345	99.850
1800 " 20 "		.133	53.292	99.751
" 1 hr.		.645	52.780	98.790
2200 " 15 min.		3.231	50.194	93.652
" 20 "		5.916	47.509	88.926
" 35 "		1.558	51.867	97.102
" 2 hrs.		1.181	52.244	97.780

It will be noted that a larger amount of sulphur remains in the residues when higher temperatures have been applied. I account for this by the fact that the high temperature being quickly reached, a sudden fusion of some of the particles of pyrites enclosed a portion of the sulphur in such a way as to prevent the action of air upon it.

A high temperature is, therefore, not needed for the complete decomposition of FeS_2 , when air has abundant access. We say "complete" decomposition, for, although sulphur still is present in small amounts, yet the expulsion of 98 to 99 per cent. of it is, to all intents

and purposes, "complete." Even at a temperature as low as 1250°F. , 98.68 per cent. of the sulphur present was expelled when air had free access. At slightly higher heat, 99.85 per cent. was driven off. These results do not bear out the very prevalent idea that, after having got rid of half the sulphur of pyrites, a much higher temperature is required to expel the remainder.

In this connection Ledebur, in his *Metallurgy*, says:

"Pyrite and marcasite are decomposed even at a low temperature, while about half the sulphur is volatilized (if air is present, burning to SO_2 ; if not, passing off as vaporized sulphur) and a compound remains whose constitution corresponds nearly to pyrrhotite (Fe_7S_8). By simple heating, without air, this lower sulphide of iron cannot be further decomposed. If, however, atmospheric oxygen has access to the glowing compound of sulphur and iron, a further part of the sulphur burns, volatilizing as SO_2 ; the remainder forms next, with the iron, sulphate of iron, which is decomposed, even at a red heat. A part of the oxygen of the SO is used for the higher oxidation of the iron, basic sulphates of iron oxide are formed, and SO_2 vaporized; on still further raising the temperature, the basic iron salt is also decomposed, SO_2 driven off, and oxide of iron remains behind."

In general, the above-described experiments agree with this statement of Ledebur. But it must be remembered that in saying that "half the sulphur is volatilized" at a low heat, he evidently means the one atom of sulphur in FeS_2 . This, however, only reduces the sulphur from 53.33 per cent. in FeS_2 to 39.66 per cent. in Fe_7S_8 . My results have shown that this is the actual result, although with a white heat, without air, I have succeeded in reducing the sulphur to a somewhat lower point.

From the two tables given it appears that, for proper desulphurization of pyrites, air is absolutely necessary, and of greater importance than an excessively high temperature.

Experiments made by Dr. Menges as to the amount of air needed for proper desulphurization of FeS_2 , gave the following results: Working with similar quantities of pyrite in each case, in a current of 900 cubic centimeters of air per minute, the sulphur volatilized without any subsequent condensation in the tube, and on gradually reducing this quantity to 450 c.c., and then to 300 c.c., no condensation occurred. Starting with a current of 400 c.c. per minute, the sulphur volatilized, condensed again further on in the tube, but was subsequently oxidized in the same current without raising the heat. These results show that with ample air-current all sulphur volatilized will readily burn to SO_2 , and that in a deficient air-current any sulphur condensed will be subsequently removed.

In view of the fact that many furnace-men are under the impression that pyritiferous ores can be largely desulphurized in the upper part of the blast-furnace, the following experiments were made: Samples of pyrite were heated in a current of gas taken from the "down-take" flue of a furnace. The gas had the following composition by weight:

	Per Cent.
Carbonic oxide.....	31.17
Carbonic acid.....	10.06
Nitrogen.....	58.72

The results were as follows:

Approximate Temperature in Deg. Fahr.	Duration of Heat.	Per Cent. Sulphur in Residue.	Loss.	Per Cent. of Total Sulphur Expelled.
Original Pyrites.....		53.42		
1250 " 10 min.		41.14	12.22	22.98
" 1 hr.		33.93	19.48	36.68
1800 " 25 min.		33.88	19.54	36.58

These figures show that the desulphurization of pyrites in an atmosphere of furnace-gas is, at best, only partial, the results being comparable to those obtained when it is heated without access of air. In view of the already ascertained necessity for oxidizing atmospheric surroundings, it could but be expected that in an atmosphere devoid of free oxygen only partial desulphurization could be effected. The furnace-man who hopes to use the top part of his furnace as an ore-roaster has little success to look for.

When sulphate of iron occurs or is formed in the processes of roasting, the question arises as to its behaviour on heating; whether or not the presence or absence of air has any influence. It was, of course, known that sulphate of iron decomposes on heating to ferric oxide and sulphur trioxide,* but having seen no statement as to the effect of the presence or absence of air, I made the following experiments:

Two heats, in presence of air for twenty and thirty minutes respectively, at about 1600°F. , gave residues

showing 0.031 and 0.030 per cent. of sulphur; 99.87 per cent. of the original sulphur having been expelled.

Three heats, with the air excluded, at somewhat higher temperatures than the above, for thirty, thirty-five and sixty minutes, gave residues showing, respectively, 0.04, 0.04, 0.002 per cent. of sulphur; 99.81 to 99.9 per cent. having been expelled.

Sulphate of iron is decomposed by heat alone, the presence of air or its absence having no influence. From this it may be inferred that sulphate of iron is harmless in the blast-furnace, its sulphur being expelled by heat in the form of SO_3 and passing out with the furnace gases. The harmlessness of sulphate of iron is, indeed, known to most furnace-men, although all are not familiar with the reasons for it.

In view of this behaviour of sulphate of iron, we inquire next, how far the manner of heating pyrites affects its presence in the residue. Does the presence or absence of air affect the percentage of sulphur in the residue present in the form of sulphate, which we have found to be harmless? To throw light on this point, residues from some of the heats were analyzed to find how far the sulphur contents was in the form of sulphate of iron.

1.—PYRITES HEATED WITHOUT ACCESS OF AIR.

Temp. F. Approx.	Duration of Heat.	Total Sulphur in Residue.	Sulphur as Sulphide.	Sulphur as Sulphate.	Per Cent. of Total Remaining Sulphur as Sulphate.
1250	5 hrs.	42.591	42.399	0.192	0.45
1800	1 hr.	39.389	39.247	0.142	0.39
2600	30 min.	29.519	29.485	0.034	0.10

2.—PYRITES HEATED IN PRESENCE OF AIR.

Temp. F. Approx.	Duration of Heat.	Per Cent. Total Sulphur in Residue.	Sulphur as Sulphide.	Sulphur as Sulphate.	Per Cent. of Total Remaining Sulphur as Sulphate.
1250	2 1/4 hrs.	0.70	0.231	.469	67.00
1800	1 hr.	0.645	0.158	.487	75.50
2200	2 hrs.	1.181	0.687	.494	41.83

There is a very marked difference in the results. It might be expected that free access of atmospheric oxygen must be a condition for the conversion of sulphide into sulphate. The results show clearly the correctness of that view. Without access of air, practically all the sulphur remaining is in the form of sulphide, but when air has access, a large part, sometimes the larger part, is in the form of sulphate, a fact which, in view of the harmlessness of the latter in the blast-furnaces, emphasize the necessity for abundant air in the roasting of pyritiferous ores. Not only is the sulphur removed in this case, but even of what remains, the greater part is harmless.

In this connection, it was of interest to note the effect of heating in an atmosphere of furnace-gas on the amount of sulphur left in the residue in the form of sulphate. Analyses of the residues from those heats made in a current of furnace-gas, given above, showed as follows:

Temp. F.	Duration.	Per Cent. Totals in Residue.	Sulphur as Sulphide.	Sulphur as Sulphate.	Per Cent. Total Sulphur as Sulphate.
1250	10 min.	41.148	41.089	0.059	0.143
1250	1 hour.	33.882	33.800	0.082	0.212
1800	25 min.	33.936	33.806	0.130	0.382

These results show that this manner of decomposing pyrites is not conducive to the formation of sulphate in the residue, and that the results here, also, are comparable to those got by heating without access of air.

It must be borne in mind that all the above experiments were made on sulphide of iron alone. The question arises whether the conclusions reached on pure pyrites will hold good for a pyritic ore. Of course, sulphide of iron can be expected to act in the same way under the same circumstances under the action of heat. Whether or not an ore containing it will permit desulphurization on the basis of the above-ascertained behaviour of FeS_2 depends entirely on the character of the ore itself. If its structure is sufficiently porous to allow air to gain a ready access to the interior of the ore-pieces, it can be expected to sulphurize at a low heat. If it is a close, dense ore, this characteristic is equivalent to exclusion of air from the greater part of its sulphur contents. Dense

* Colorado Meeting American Institute of Mining Engineers.

* "Roscoe & Schorlemmer," vol. ii., Pt. 2, p. 101.

ores are not difficult to sulphurize because they cannot be heated properly, but because air cannot penetrate them. Therefore, because pyrites can be decomposed at a low heat in presence of abundant air, it does not follow that all ores can be desulphurized under corresponding conditions. While it may be said that atmospheric oxygen is a *sine qua non* for proper roasting, no general rule can be laid down concerning the proper temperature to be used.

In order to test the correctness of these views, the following experiments were made:—Small pieces of Cornwall ore, about the size of a walnut, containing, as nearly as could be judged, the same amounts of sulphur, were heated at low temperature under free access of air. The original raw ore showed 2.644 per cent. of sulphur. The following results were obtained:

Temp. F.	Duration.	Per cent. Sulphur in Residue.	Loss.	Per cent. Total Sulphur Expelled.
1200	2 hrs.	.346	2.318	87.01
1200	4 "	.178	2.486	93.31
1500	1 hr.	.099	2.565	96.28

From these results it would seem that a comparatively open-grained and porous ore can be readily desulphurized at a comparatively low temperature when air has access freely.

The necessity of an oxidizing roasting so that the sulphur remaining shall, as far as possible, consist of sulphate, is proved by an analysis of the same ore:

Temp. F.	Duration.	Per Cent. Total Sulphur in Residue.	Sulphur as Sulphide.	Sulphur as Sulphate.	Per Cent. Total Sulphur as Sulphate.
1200	2 hrs.	.346	.235	.111	32.18
1200	4 hrs.	.178	.088	.090	51.12
1500	1 hr.	.099	.027	.072	72.72

The importance of having the remaining sulphur as far as possible in the form of the harmless sulphate, and of an oxidizing roasting to secure this end, can be readily seen.

Experiments were also attempted with a very dense Jersey magnetite, but it was found impossible, with the stock of it on hand, to select small pieces comparable as

to their sulphur contents, and the results were worthless.

One thing, however, was clearly shown, namely, that the density of this ore so completely excluded air from the interior of the ore-pieces, as to make futile any attempt to desulphurize it at a low temperature. It required the use of a high heat.

The action of the heat itself on the ore probably varies. It may either cause a cracking of the ore-piece and allow the entrance of air in that way, or it may act, as pointed out by Akerman, in enabling the sulphur to take up oxygen from the ore itself, for its oxidation. It is certain that the degree of heat required for desulphurization varies with different ores; but an abundant supply of air should always be present.

It is certainly possible, however, to use too high a heat. It may be questioned whether a pyritiferous ore should ever be heated fully to its sintering point. A fused ore is harder to reduce in the furnace, and heating it to that point appears to be often exceedingly prejudicial to proper roasting.

To test this point—how far fusion or clinkering of ore affects the amount of sulphur that can be expelled, and how far its influence goes to affect the amount of the sulphur remaining in the clinker present in the form of sulphate, the following experiments were made.

(To be Continued.)

MICHIGAN, Houghton,

Michigan Mining School.

A State School of Surveying, Mining, Electrical and Mechanical Engineering, Physics, Chemistry, Assaying, Ore Dressing, Mineralogy, Petrography, Geology, Drafting, Machine Design, etc. Tuition free. For catalogues and information address M. E. WADSWORTH, A.M., Ph.D., Director.

LEDOUX & COMPANY,

10 CEDAR ST., NEW YORK.

Engineers, Metallurgists & Assayers.

Public Ore Sampling & Storage Works

All the principal buyers of furnace materials in the world purchase and pay cash against our certificates of assay, through New York banks.

By special permission of the Secretary of the Treasury of the United States, cars of ore or copper matte passing through in bond can be opened and sampled at our works.

Consignments received and sold to highest bidder. Send for circular giving full particulars.

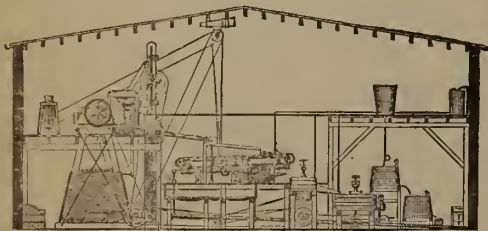
Mines examined and sampled. Assays and Analyses of all kinds.

Charles M. Rolker,

— LESSEE, —

New York Ore Milling & Testing WORKS.

Office, - - 18 Broadway, New York.



Cable Address:—PHAFTRY, New York.

Consulting Mining Engineer.

Examinations made and reports rendered of mines and mining property, metallurgical works and processes.

Ores can be practically tested by any known process and the necessary plan of reduction determined. Works are complete in every respect for practical testing of Gold, Silver and Concentrating Ores and Tailings. ANALYSIS of ores and furnace products, etc.

Miners, Contractors & Quarrymen

Light Steel Rails and Fastenings.
Hand Cars. Steel Barrows.
Crow Bars. Steampipe and Fittings.
Valves, Gauges, &c.

J. & H. TAYLOR,
MONTREAL.

Lead Lands for Sale.

- Township of Galway, Ont. -

Three Hundred Acres (300) showing excellent and most promising Veins of Galena Ore, varying in size from ten inches up to two feet in width, extending over the whole property.

These lands are situate within a few miles of the line of the Grand Trunk Ry., and adjoin the Galway Mines in the Township of Galway, Ont.

This property will be sold very reasonable. Part payment taken in stock of a working company.

Reports by Prof. E. J. Chapman and others, and the fullest particulars may be obtained on application to

H. CALCUTT,

PETERBOROUGH, ONT.

CANADA ATLANTIC RAILWAY.

THE SHORTEST PASSENGER ROUTE BETWEEN

Ottawa & Montreal

AND ALL POINTS EAST & SOUTH.

The only road in Canada running trains lighted with electricity and heated by steam from the engine. Luxurious Buffet Pullman Palace Cars on all trains between Ottawa and Montreal. Only line running through Sleeping Cars between

OTTAWA, BOSTON AND NEW YORK

And all New England and New York points.

Baggage checked to all points and passed by Customs in transit. For Tickets, Time Tables and information apply to nearest agent or to
S. EBBS, City Passenger Agent,
GEO. H. PHILLIPS, Gen. Agent, 24 Sparks St., OTTAWA.
VALLEYFIELD.

A. E. CAIRNS, General Agent,
136 St. James St., MONTREAL.

Or at 260 Washington St., Boston, and
317 Broadway, New York.

E. J. CHAMBERLAIN, General Manager,
General Offices, Ottawa.
C. J. SMITH, General Passenger Agent.

JOHN J. GARTSHORE,

TORONTO,

NEW AND SECOND HAND

Rails and Cars for Tramways.

SOME GOOD CARS NOW ON HAND
FOR SALE CHEAP.

SOCIÉTÉ

Canadienne d'étude Minières

CAPITAL, - - \$100,000

Assaying, Prospecting and Mining.

HEAD OFFICE, - - - 30 St. FRANCOIS XAVIER ST.

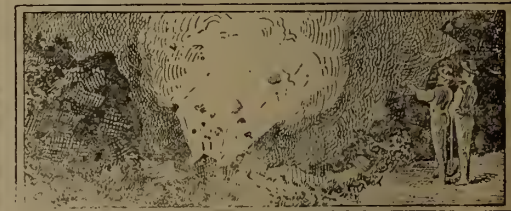
P. O. Box 1625, MONTREAL.

Office in Paris (France) 12 Place Vendome.

DIRECTORATE:

M. SCHWON, Vice-Consul of France, President
JOHN S. HALL, Q.C., M.P.P., Vice-President.
C. A. DUGAS, Judge of Sessions }
C. H. A. GRANT, Directors.
C. DUQUET, Alderman, Quebec, }
G. WERNER, Secretary and Treasurer.
L. DE LA VALLEE POUSSIN, I.C.P. }
JOHN D. FROSSARD, M.E. Consulting Engineers.
JOHN S. HALL, Q.C., M.P.P., Advocate, Legal Adviser of the E.I.

Standard Powder Company



MANUFACTURERS OF ALL KINDS OF

GLYCERINE

EXPLOSIVES

—FOR—

MINING

—AND—

RAILROAD WORK.

ADDRESS—

W. H. HARRISON,

MANAGER,

BROCKVILLE, ONT.

The Canadian Mining Review

CONDUCTED BY OFFICES: B. T. A. BEL
UNION CHAMBERS, 14 METCALFE ST.,
OTTAWA.

Vol. IX. AUGUST, 1890. No. 8.

An Absurdity of the Tariff.

During the last session of Parliament there was an effort made by several members representing mining constituencies to have the oppressive and prohibitory duties on mining machinery removed. As the result of this effort the following section appeared in the new Tariff List, bearing date of March 28, 1890: "Free mining machinery imported within three years after the passing of this Act, which is, at the time of its importation, of a class or kind not manufactured in Canada."

The appearance of this section gave great satisfaction to the majority of the mining interests, and to the gold miners in particular, who have had to pay the heavy burden of 30 per cent. upon almost all the machinery used by them in mining and milling, and to whose product, from its nature, the N. P. did not and could not afford protection.

Several importations under this Act have come under our personal knowledge, some have been allowed free entry, others had to pay duty, and of this latter class we propose to speak briefly. The language of the section being so clear, and also so comprehensive, it was not supposed that any difficulty could be encountered in its administration.

But in the following case it would seem that the department, or its officers, chose to put their own interpretation upon the words, "mining machinery." Several importations, at divers times since the 28th of March, were made of silvered copper plates which are a part and parcel of the amalgamating machinery of every modern gold mill. These plates are used to catch the fine gold coming from the stamps, and are made of soft rolled copper, subsequently annealed and coated or plated with a thin layer of metallic silver upon one side. They are not used in any other business, or for any other purpose. Entry was sought to be made under this Act, and by the Local Collector was referred to Ottawa, where the ruling was made by the then Acting Assistant Commissioner of Customs that such plates "are not mining machinery, such as was contemplated by this Act."

The absurdity of this reply and its illogical character is briefly shown.

First, as to the fact of its being of a "class or kind not manufactured in Canada." There are no copper works in the Dominion to-day which do or can make the plain copper plates and anneal them. Further there is not an electroplating establishment in the Dominion which has a bath large enough to take in and properly plate these coppers with silver; hence even were the coppers available, the manufactured amalga-

minating plates could not be produced, at present, by any concern in Canada. It is, therefore, evident that these plates are of a "class or kind" which not only *is* not, but which *can* not at the present time be made here.

Now as to the point that these amalgamating plates are not "mining machinery." A gold mine is of little or no value without a mill, and no gold mine that we know of ever *was* a mine until it had a mill. No gold mill is equipped to save the fine gold unless it has these amalgamated plates, which are a necessary and integral part of the machinery and plant. They are just as essential to the proper and economical working of a gold mine as the engine which hoists, or the air drill which bores the rock, or the pump which keeps the mine clear of water, or the stamps which crush the rock. Being, therefore, of such importance that they are "mining machinery" would appear to us to be axiomatic.

In the discussion in the Commons on the 26th of March, on the matter of admitting machinery free of duty, the interpretation of the words "mining machinery" was not directly alluded to, but incidentally was fully expounded from the context. As examples we may quote Mr. Mara, who, when speaking of Kootenay, said: "Here we have hundreds of tons of ore on the dumps that, in treating, would give employment to a great number of men," obviously this treatment referred to is metallurgical. He says further when speaking of British Columbia: "We say that such machinery as concentrating machinery, quartz mills, reduction mills, etc., are not manufactured here. * * * We ask that the Government will take the duty off that class of machinery for a short time." Mr. Dawson said: "There are certain things such as diamond drills and amalgamators which are not produced in this country."

Mr. Charlton, who was a member of the Ontario Mining Commission, in speaking of his experience on that Commission, said: "It was found that various kinds of machinery were not produced in Canada, such as for amalgamating work, stamps, diamond drills, etc."

We would, therefore, like to ask Mr. Assistant Commissioner of Customs what mining machinery *was* "contemplated by this Act."

The gold miner usually has a hard enough time to make his mine pay, and if he, in the future, shall have to spend time to find out what "was contemplated" by the Tariff when it says one thing and means another, he will pray for the deace of the Tariff or the "contemplator" or both.

Florida Phosphates.

Dr. Francis Wyatt, of New York, who has recently returned from a professional visit to Florida fully bears out our forecast of Florida as a competitor in the phosphate market. Here are his concluding remarks:—"To take up such short options as are now offered on lots

of land in various counties at great distances from each other, under any conditions of price or surface indications, is simply suicidal, since they allow no time for efficient inspection. The country is wild and practically unsettled. Traveling in the interior is attended by the greatest difficulties and inconveniences. There are no wagon roads suitable for transportation purposes, for the horses sink everywhere knee-deep in sand. The railroad facilities, broadly speaking, are nearly nil, and the postal and telegraphic services are utterly inadequate. Under these circumstances (and I am rather understating than overstating facts), the control of a widely disseminated lot of workings carried on simultaneously would be impossible.

As to the question of quality and usefulness of these phosphates, I consider that the large number of my analyses of samples taken in all directions and under all kinds of conditions gives a satisfactory answer. It has been said that these phosphates are, to a great extent, combinations of phosphoric acid with alumina and iron, but I have shown that in the great majority of cases this is really a misapprehension. On the whole, their average richness is less than we were led to expect, and the proportion of really high grades is extremely small. While I can see no present outlet of importance for the second-class matter, the rich boulder material compares favorably with many others much appreciated by manufacturers of superphosphate. If they are properly selected before shipment, I can, therefore, foresee no possible objection to the high grades, and I believe they will find a ready market at European ports directly their composition is fully understood."

Dr. Wyatt thinks the field may prove profitable to those who purchase and work mines with judgment: but intending purchasers are warned of the disastrous results that will follow to those who are led away by the prevailing "boom" and pay exaggerated prices for surface indications or anything but high grade test.

Arbitration.

The losses sustained through the deplorable strikes at the Springhill and Wellington collieries, not only to the employers and employes, but also to the consuming public, is fitting illustration of the necessity of arbitration as a simple and suitable method by which these and all other demoralizing disputes may be smoothed over and adjudicated. For many years boards of arbitration have coped with the great conflicts between capital and labor in Europe, Great Britain and the United States, and having proved successful in these countries it cannot be doubted that in instances like the present they would be of immense service to both parties in effecting a satisfactory solution of the questions at issue. The benefits that these boards have conferred upon the coal and other trades are incalculable. A most friendly feeling has taken the place of hostility, and confidence and mutual respect

now exists where formerly all was suspicion and hatred. The changed relations of employer and employed have been recognized; they have met at the same table as equals; and out of this has grown a condition of affairs that will make it impossible for the old conditions to return. Mr. A. J. Mundella, M.P., who has been so largely instrumental in the initiation of this wise institution in England, gives many striking instances of the successful operation of permanent arbitration boards in that country. He says: "If the workman of any branch conceive that they have grievances to complain of, in addition to the ordinary representatives of that branch a delegate may attend and lay the case before it. The first business at our meetings is to receive delegations. They retire after having made their statements, and the board proceeds to deliberate. We have never met without settling at least half a dozen questions, some important and some trivial, which, if allowed to remain open, would produce irritation. * * * A large part of the credit of the success of this board, and this change in the relations of classes, is due to the provision for regular meetings of the board. The great curse of industry, and the fruitful cause of difficulty, is a foolish obstinacy and a false pride. This arises in many cases from a want of knowledge and a lack of common courtesy in matters concerning both capital and labor, and in which both have an equal interest. This quarterly coming face to face, this meeting as equals,—and in all questions that come before this board they are equals, and it is foolish to ignore this fact,—and this discussing of subjects of common interest as sensible men seeking for the facts and inclined to moderation and concession if need be, have had a marvellous effect in removing this pride and obstinacy, and bringing about that respect and courtesy that must be the basis of all friendly negotiations between capital and labor." In France there is the "Conseils des Prud'hommes," probably the oldest system of arbitration in existence, and which provides a simple and effective method of adjudicating all labor troubles and disputes. They are composed of an equal number of masters and workmen, each trade electing its own representatives, with a president and vice president named by the government. Arbitration is compulsory upon the application of either, and the decisions of the court can be enforced the same as any other court of law. Fully 95 per cent. of the cases brought before these boards have been amicably settled. In the States of Massachusetts and New York, and elsewhere in the United States, arbitration has speedily and unostentatiously decided many cases, which, if allowed to proceed, would have developed into serious strikes and lock-outs. Trade disputes, such as those at Springhill and at Wellington, are, happily, of rare occurrence; but as our country develops, and our mineral and other important industries expand, the possibilities of more frequent friction are apparent. So im-

pressed was the Royal Commission appointed by our own Government to enquire into the relation of capital and labor, that in their Report, published last year, the necessity of a permanent, as well as local boards in industrial centres, was strongly emphasized. During the last session of the Legislature of Nova Scotia provision was also made, under the Mining Act, whereby labor disputes should be submitted to a board to consist of two arbitrators appointed by the workmen, two representing the company, the four thus chosen to select a fifth, or umpire. This was an excellent and wise provision. But at Springhill it appears that the company refused to submit to arbitration, apparently determined to starve the men into their unreasonable demands. The result has been eight weeks of a most distressful strike, which has not only crippled the operations of the company and been keenly felt by the men, but has also seriously affected trade, both in the vicinity of the mines and in the upper provinces. Strikes are neither rational nor civilized, and, as in these cases, invariably involve loss and hardship. The vital interests of master and miner must necessarily depend on unity, and only by the harmonious action of both can great material progress be attained. Let both meet each other fairly in a spirit of full acknowledgment of each other's rights and duties; when differences occur let them be submitted to a competent board of arbitrators; and when one or other fail to agree on this course, as at Springhill, and at Wellington, let the government step in and make immediate arbitration compulsory.

Suicidal Strikes.

Mr. Powderly, the prominent leader in the labor disputes across the border, is reported to have said, at a Pennsylvania meeting on the 14th June last, "But we are not in favor of strikes. We think they are suicidal. I will say that I have never known of a strike which has been won by the men where the evil consequences have not overbalanced the benefits." The miners at Springhill and at Wellington will bear witness to the truth of his statement.

Cement in Ontario.

The value of the export of cement from Britain to the United States and Canada, for the first half-years of 1888, '89 and '90, stands as follows:—

	1888.	1889.	1890.
To United States...	\$1,094,126	\$941,075	\$1,190,375
To Canada.....	64,000	78,107	108,538

Our neighbors claim they are making cement equal to the English article, but their importations show no decline. The maximum duty is 40 cents, which should not be prohibitory of the Canadian article if we had a first-class one to offer. And why not? We should be well able to make first-class hydraulic cement in Ontario.

Steam Pumps.

Hints on their Selection and Practical Management.

(From the Safety Valve.)

In the first place, regarding the selection of a steam pump, with so many excellent pumping machines in the market, this is a difficult subject to discuss and one that we cannot go into without doing somebody an injustice. It must therefore suffice if we direct attention to a few cardinal points that every steam pump to be entitled to choice should possess. Simplicity of construction is materially an advantage, but like everything else, it may be overdone. In itself it can hardly be regarded as forming a reliable basis for selection, although the simplest pump that conforms to all other requirements, such as efficiency, durability, reliability, &c., is undoubtedly the best. At the same time, the very nature of the work a steam pump is ordinarily called upon to perform, demands that its parts shall be readily accessible for inspection, and neither so costly nor so intricate as to be difficult of replacement in case of wear or breakage. A pump that is made on the interchangeable plan as to its parts, has many advantages in this respect. This applies particularly to the water valves, which are liable to become obstructed by foreign bodies in the water or where the pump is employed for moving thick or gritty fluids.

Select a pump if possible in which the valve motion is reliable at any speed—in other words, a steam pump that can be run at the extreme limit of slowness or at its highest capacity without fear of the steam valves failing or becoming deranged. Pumps have been placed on the market that are liable to slacken off and stop if run "dead-slow," or to run away if left to operate at high speed, and such unreliability, especially where boiler feeding or circulating service is demanded, is likely to prove dangerous. A pump that has "dead centers," is for like reasons undesirable and it is moreover a frequent source of trouble where it is necessary to "start up" in a hurry. A reliable steam pump, such as the best makers supply, will run steadily and constantly at a speed proportionate to the steam supplied and will start promptly from any part of the stroke as nearly as possible at full pressure. The pump valves should have an area of about one-fourth the area of the pump.

Never buy or install a pump that you suspect to be too small for its duty; one or two sizes too large will do no harm, but half a size too small will make an immense amount of trouble. It is easy to determine the capacity of a pump by multiplying the area of the piston in inches by its stroke in inches which will furnish its full capacity per stroke in cubic inches, and divided by 231, in gallons. An allowance of at least twenty per cent., and in some instances more, must be made in these calculations for the leakage caused during the rise and fall of valves, inaccuracies in fitting, &c., as well as the "clearance" between the valves and the piston or plunger. If it is a question of forcing water to a certain height, multiply the amount of water in gallons to be raised per minute, by the weight of one gallon (835 pounds) and the product by the height in feet of the discharge from the point of suction. The result, divided by 33,000, will give the theoretical horse power required to accomplish the work, but a liberal allowance, never less than ten per cent. and in some cases as high as thirty per cent., must be made for friction in pipes and bends, for leakage in pipes, leakage and friction in pump, &c. The speed at which a pump should be run must also be taken into consideration—a boiler feed pump, for instance, should not be run at a higher speed than about forty double strokes per minute. Where water has to be pumped through a long and particularly a vertical line of pipe, a slow movement is more economical and will furnish the best results. A small pump, working rapidly, is subject to greatly increased wear and tear under such conditions, especially where no check valve is provided to relieve the pressure on its valves. The velocity of water in pump passages should not exceed 500 feet per minute.

For condensing engines, the feed pump should have a pump plunger equal in diameter to one eleventh the diameter of the steam cylinder when the pump stroke is one-half the engine stroke and one-eighth the diameter of the steam cylinder when the pump stroke is one-quarter the stroke of the engine. The capacity of a pump for boiler feeding should never be less than one cubic foot of water per hour to each horse power. It must be considered also that water expands when heated, and where hot water is used in feeding, the capacity of the pump should be increased so that it equals the equivalent in cold water.

In setting up a steam pump run all lines of pipes as direct as possible, every bend increases the friction to be overcome. Short bends and short angles should be avoided wherever possible; they retard the flow of water and increase the work of the pump. Where turns or bends must be made, have them as easy as possible. Pipes should be as large as the pump connections at least, and where very long or very crooked, larger sizes must be used. The discharge pipe should never be re-

duced in capacity between the pump and the discharge, especially in feeding boilers. Where pipes are branched to divide the discharge it must be remembered that the area of a pipe primarily governs its capacity; two 1-inch pipes discharge about the same amount of water as one pipe 1½ inches in diameter. The length of a pipe must also be taken into consideration. A pipe two inches in diameter and 100 feet long will only deliver one-fourth as much water as a pipe of the same diameter and only two inches in length.

The suction pipe especially should be made as direct as possible and, above all things, should be perfectly tight. A very small leak in it will greatly impair the efficiency of the best pump. A large one will positively neutralize its action. In locating a pump with regard to suction, it must be remembered that the ordinary suction pump will hardly lift water at sea level more than thirty feet with the most perfect vacuum ordinarily obtainable. It is unwise to depend on a pump doing as much as this, differences in elevation, etc., being considered, and from twenty to twenty-five feet should be the limit to which a pump should ordinarily be taxed. Where water is to be raised to a greater height than this, a force pump, or combined force and suction pump, should be employed. Very hot water cannot be handled by a suction pump, the reduction of atmospheric pressure prior to the lift causing its transformation into steam and vapor. The placing of an air chamber in the suction pipe, by keeping a large body of water near the plunger, makes the supply steadier. It should be made long in the neck, so that when the water is passing through the pump barrel it may not be forced up into the chamber. This would result in an absorption of the air in the chamber and a consequent reduction of the supply of water. Every pump drawing its supply from tanks, wells, rivers, ponds, etc., should have the end of the suction pump covered by a strainer.

The exhaust pipe of a steam pump should be made to run downward when convenient. This will enable the water of condensation to flow out in place of requiring to be driven out by the exhaust.

Finally, the pipes of all pumps located in exposed situations should be provided with unions, so that on extremely cold nights the pump may be detached to prevent freezing. For the same reason the drip cocks of both steam and water cylinder should be left open whenever the temperature is likely to fall below freezing while the pump is standing idle.

Steam pumps, like all other machines, require careful attention to insure their efficiency and durability. It is necessary to see that they are well lubricated and well wiped at regular times and at frequent intervals, especially in the case of boiler feeding or circulating pumps, they should be looked at to make sure that they are not only running, but doing their work. The check valve furnishes one indication of their satisfactory operation. If it rises and falls regularly with each stroke of the pump and its vibrations are communicated to the feed pipe below the valve, the pump is working. It is as well to shut off the stop cock between the check valve and the boiler in a feed pump now and again, and, taking out the check, allow the pump to make a few strokes, which will remove any sediment or foreign substance from the seat. If, although the pump may be running, the water in the tank or boiler does not show its effects, some defect may be looked for. A leak in the suction pipe, worn or loose packing, water or check valves obstructed by some foreign particles, water supply shut off, or, in the case of a well fed by springs, fallen below the point of suction, or pipes choked with such mineral sediments as lime, salt, and other water deposits are among the commonest causes, and can be remedied by any engineer. In the case of a boiler feed pump located near the boiler it is likely to become heated and may, in such a case, fail to lift. The pet cock in the pump barrel may be opened and the accumulated hot water run out, after which it will usually be found that the pump will resume work.

The above points include such as may be regarded as of general importance. There are others that will occur to our readers from time to time, especially where pumps are employed as in breweries, oil refineries, distilleries, chemical works, etc., for moving thick or volatile fluids, or such as are likely to exercise a destructively corrosive effect on metals or packing substances.

A Strikers' Paradise.—Strikers seem to have a paradise in New South Wales. At Sydney the dock laborers threatened to suspend operations unless they were allowed a certain period of the day to smoke their pipes or cigars. Rather than precipitate a conflict with their men on so trivial a matter, the masters have allowed them three-quarters of an hour per day for indulgence in tobacco, and have agreed to pay them for it, too. The next step in concession will be to supply these hard-worked operatives with a particularly fine brand of tobacco and highly ornamented Dutch pipes. But it must be said in favour of this agreement that men work with freshened energy when they have occasional intervals of rest or idling.

A New Canadian Enterprise.

The Dominion Iron and Steel Company has been incorporated at St. John, New Brunswick, with a capital stock of \$500,000. The company is formed for the purpose of erecting and operating mills for the manufacture of rolled and hammered iron, bar iron, cut nails and spikes, horseshoes, railroad and other spikes, fish plates, polished shafting and other articles. The plant is to be built in the vicinity of the city of St. John, on the Bay of Fundy, accessible by vessels and adjacent to lines of railway that connect with all the points east and west. The building will contain four train rolls, ten furnaces, nail and spike factory with 50 machines, a horseshoe machine, with a general machine shop and shafting department. The mills will be built, equipped and operated in the most modern and approved manner, and will strive to equal the output of similar concerns in the United States. The capacity of this plant per month is to be 240 tons cut nails and spikes, 760 tons scrap iron bar and 40 tons horse-shoes, besides shafting and other articles of manufacture. The men who are at the head of this enterprise point to the fact that 40,000 tons of rolled and hammered iron were imported into the Dominion of Canada from Great Britain in 1887. They further recite the fact that while scrap iron enters the Dominion at a tariff duty of \$2 per ton, the duty on nails is 1 cent per pound, and that on scrap bar iron, etc., is \$13 per ton.

This plant will be fed with Nova Scotia and New Brunswick coals, and by being located on the Bay of Fundy it hopes to escape the high freights now paid by the Western Iron Works, which plant is compelled to carry also a stock of coal sufficient for the winter months. The water location selected will admit of weekly supplies being received the year through. They say they will be able to put the finished product of their plant in Montreal, Toronto, and other western towns of the Dominion at the same rate per ton as it costs the iron plants there to freight their coal. The erection and equipment of this plant will cost \$200,000. The company will use scrap iron imported from foreign countries until Canadian pig can be produced cheaply enough to compete with the cost of scrap.

This company makes the following comparison with the prices in the United States markets to show the prospects for good profits:—Cut nails in the Canadian market are worth, at wholesale, \$2.60 per keg of 100 pounds for two-penny and upwards; other sizes in proportion, while in the Boston market they are selling at \$2.05, a difference of 55 cents per keg of 100 pounds, equal to \$11 per ton.

Colliery Ventilation.

In a recent paper read before the summer meeting of the Institute of Mechanical Engineers Mr. E. Bainbridge said:—

"The elements of danger, waste and inconvenience in furnace ventilation for mines have caused an almost general adoption of mechanical ventilators; and many endeavours have been made to improve the ventilating fans which were in existence twenty years ago.

Fans.—The considerations to be aimed at in selecting a mechanical ventilator are as follows:—First cost of fan, engine and foundation; future cost of maintenance; economy of fuel and stores; useful effect of fan. Several committees of mining engineers have been formed to report upon the relative merits of various machines; and as at the present time a series of exhaustive experiments is being made by a committee of the Northern Institute of Engineers, it may be sufficient if in this paper the writer simply refers to some of the chief types of ventilating fans in operation in this country, at the same time giving particulars of a case in which each separate fan is now adopted. These fans are the Guibal fan, Walker's improved Guibal fan, Cockson's, Schiele's, Capell's, Waddell's and Lupton's fans.

The Guibal fan is that most largely adopted, and is so well known that it needs no description. In Walker's improved Guibal fan the chief variation in the style is the same results with a small diameter of fans and the air, instead of being admitted, as in the Guibal fan, on one side only, is admitted on both sides. The Guibal movable shutter is replaced by an anti-vibrating shutter, which is very effective in its action. The tendency recently has been to adopt fast-running fans, which, however, are most suitable where limited quantities of air are required. Four years ago the writer adopted this principle at the Woodthorpe Colliery, near Sheffield, by applying an 8 foot Cockson fan, driven direct without gear by one of Willans and Robinson's direct acting engines, which runs very quietly at a speed of 280 revolutions per minute. At this speed the fan gives about 58,000 cubic feet of air per minute, with 3 inches of water-gauge. The engine since it was started has run about 500 million revolutions, and has cost a very small amount for repairs. The actual economy in the useful effect of a fan depends upon the cost of fuel; but bearing in mind that the useful effect is found to vary from about

15 per cent. to 70 per cent., the matter is of importance; and in the ordinary carrying on of a colliery the quantity of fuel used in driving a fan engine, which practically never stops working, may be said to be one-fourth of the entire fuel used. A simple contrivance in connection with ventilating machines, which the writer is adopting at the Nuntery Colliery, may here be mentioned. A new engine-house which is now being completed will be ventilated by taking a pipe from the roof and passing it into the fan chamber; the air leaving the house will pass up through two ventilators placed in the roof, and thence to the fan.

Steel Production in Great Britain in 1888 and 1889.

In 1888 Great Britain made 979,083 tons of Bessemer steel, a decrease of 42,764 tons from the product of 1887. In 1889 the production was 943,048 tons, a decrease of 36,035 tons from that of 1888, and the total decreased manufacture in both 1888 and 1889, amounted to 78,799 tons. Bessemer steel rails, in both years, nearly made up 50 per cent. of the total output. In 1888 the aggregate production of Bessemer steel rails was 979,083 tons, in 1889, 943,048 tons. As far back as 1882 the maximum output of these rails exceeded that of 1889 by 292,737 tons. Other descriptions of Bessemer steel production in the five principal districts of Great Britain in 1889 amounted to 1,665,122 tons. The average production of steel per converter in 1888 was 23,003 tons, in 1889 it was 25,156 tons. In 1889 the number of converters in operation was 60¾ acid and 22½ basic; total number in the kingdom at that time, 91 acid and 26 basic.

The total British production of basic steel in 1889 was 493,919 tons, or about 14 per cent. of the total output of Bessemer and open hearth steel of all kinds, which amounted together to 3,569,960 tons.

The aggregate output of basic steel in England, Germany, Luxemburg, Austria, France, Belgium and other countries in 1888 was 1,953,234 tons, of which 1,493,032 tons was under 17 per cent. of carbon; in 1889, 2,274,552 tons, on which 1,764,639 was under 17 per cent. of carbon.

Great Britain's production of open hearth steel in 1889 was 1,429,169 tons, an increase of 136,427 tons over that of the previous year, and 448,062 tons over that of 1887. The gain was principally made in the Cleveland district. The net increase (there was decrease in two districts) in 1889 was 136,427 tons. Of the total production of open hearth ingots throughout the kingdom in 1889, 1,357,461 tons were acid and 71,708 tons basic.

At the end of 1889 there were 274 acid and 17 basic open hearth furnaces existing in the kingdom, a total of 291, or three more than at the end of 1888.

Nickel and its Uses*.

Dr. E. D. Peters, Jr.

Common observation would suggest that the consumption of nickel for plating has increased markedly in late years, and as a fact it has more than doubled in the last decade, and even in the past two years has shown a further though moderate increase, which is true also of the German silver manufacture. But the effort is being made in Europe to extend the consumption of nickel in all possible directions. For example, by the introduction of rolled nickel plate as an advance over tin plate. Among the proposed uses none attract so much interest as the use of nickel in alloy with steel to increase the latter's strength. A French invention has effected means for preparing such alloys with regularity and even composition. Lately Mr. James Riley, of Glasgow, Scotland, has published a valuable contribution to the knowledge of the physical characteristics of various sorts of steel when alloyed with nickel which is here abstracted from "Engineering." In the first place, a visit to the place of manufacture in France demonstrated to his entire satisfaction the degree of certainty with which the desired products could be obtained from the crucible. A number of casts were made, the composition being varied at will and the quality and properties of the metal being indicated beforehand. Subsequently it was shown at English works that the composition of the metal can be as effectually controlled in the open-hearth furnace as in the crucible. Mr. Riley states that the alloys can be made in any good open-hearth furnace working at a fairly high temperature. The charge can be made in as short time as an ordinary "scrap" charge of steel—about seven hours. Working the steel requires no extraordinary care; in fact, not so much as is required in working many other kinds of charges, the composition of the resulting steel being easily and definitely controlled.

No special arrangements are required for casting, ordinary ladles and molds being sufficient. If the charge is being properly worked, nearly all the nickel will be found in the steel; almost none is lost in the slag—very different in this respect from charges of chrome steel.

The steel is steady in mold, it is less viscous than ordinary steel, it sets more rapidly and appears to be

thoroughly homogeneous. The ingots are clean and smooth in appearance on the outside, but those richest in nickel are a little more "piped" than ingots of ordinary mild steel. Any scrap produced in the subsequent operations of hammering, rolling, shearing, etc., can be remelted without loss of nickel in making another charge. No extraordinary care is required when reheating the ingots for hammering or rolling. They will stand quite as much heat as ingots having equal contents of carbon but no nickel, except perhaps in the case of steel containing over 25 per cent. nickel, when the heat should be kept a little lower and more care taken in forging. If the steel has been properly made and is of correct composition, it will hammer and roll well whether it contains little or much nickel; but it is possible to make it of such poor quality in other respects that it will crack badly in working, as is the case with ordinary steel. In obtaining a correct idea of the value or usefulness of alloys of nickel with iron or steel, it should be remembered that the composition is complicated by manganese, carbon, silicon, sulphur and phosphorus, whose influence must be carefully watched, requiring long series of experiments. In the absence of these extended series the following will still give valuable results:

In table I, test No. 6, the carbon present (0.22) is low enough to enable us to make comparison with ordinary mild steel, which would give, when annealed, results about as follows: elastic limit, 16 tons; breaking strain, 30 tons; extension, 23 per cent. on 8 inches, and contraction of area 48 per cent. Therefore, in this case the addition of 4.7 per cent. of nickel has raised the elastic limit from

16 up to 28 tons, and the breaking strain from 30 up to 40 tons without impairing the elongation or contraction of area to any noticeable extent. In test No. 3 somewhat similar results were found with an addition of only 3 per cent. of nickel, combined with an increase of the carbon to 0.35 per cent. In tests No. 2 and 5 there is extreme hardness, due in part to the large quantity of carbon present, but also to the presence of nickel in addition. In test No. 9, with the carbon very much reduced, this characteristic hardness is intensified by the increase of nickel to 10 per cent. This quality of hardness obtains as the nickel is increased, until about 20 per cent. is reached, when a change takes place and successive additions of nickel tend to make the steel softer and more ductile, and even to neutralize the influence of carbon as is shown in the test No. 2, in which there is 25 per cent. nickel and 0.82 carbon. In this matter of hardness, due to increased additions of nickel, there is some resemblance to Hadfield's manganese steel, but valuable qualities of nickel steel are reached before machining becomes extremely difficult. There are experiments showing that by hardening and tempering it may be possible to increase largely the breaking strain and elastic limit of these alloys. The alloys polish well, the color being lighter as the proportion of nickel increases.

They do not corrode as easily as other steel, the 1 per cent. nickel steel welds fairly well, but this quality deteriorates with each addition of nickel. Considerable ultimate advantage may be expected from these alloys, particularly where the percentage of nickel is less than five.

TABLE NO. 1.—PHYSICAL TESTS of Steel alloyed with varying proportions of Nickel.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
Composition:												
Nickel, per cent.	1.0	2.0	3.0	3.0	4.0	4.7	5.0	5.0	10.0	25.0	25.0	49.4
Carbon "	.42	.90	.35	.60	.85	.22	.30	.50	.50	.27	.82	.35
Manganese "	.58	.50	.57	.26	.50	.23	.30	.34	.50	.85	.52	.57
Tensile tests as cast:												
Elastic limit (tons)	a	b	19.8	.....	b	.....	.....	.....	c	.....	.....	.....
Breaking strain (tons)	.....	.....	34.9	.....	.....	.....	.....	.....	.....	.....	.....	.....
Extension per cent. in 4 inches	.....	.....	2.5	.....	.....	.....	.....	.....	.....	.....	.....	.....
Contraction of area per cent.	.....	.....	5.6	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tensile tests as cast and annealed:												
Elastic limit (tons)	27.3	.....	24.0	.....	.....	.....	.....	.....	.....	.....	.....	.....
Breaking strain (tons)	54.6	.....	34.9	.....	.....	.....	.....	.....	.....	.....	.....	.....
Extension per cent. in 4 inches	1.5	.....	2.5	.....	.....	.....	.....	.....	.....	.....	.....	.....
Contraction of area per cent.	9.5	.....	9.0	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tensile tests as rolled:												
Elastic limit (tons)	32.1	.....	31.4	29.4	.....	25.1	30.0	31.1	.....	38.2	22.0	20.5
Breaking strain (tons)	57.6	.....	51.0	51.5	.....	40.5	46.4	52.0	.....	51.4	47.6	37.4
Extension per cent. in 8 inches	.....	.....	.....	9.0	.....	17.75	10.0	14.0	.....	10.5	43.5	.....
" " 4 "	11.0	.....	20.3	10.1	.....	23.4	12.5	15.6	.....	11.7	47.6	12.0
Contraction of area per cent.	24.0	.....	37.0	9.0	.....	42.0	22.5	14.0	.....	.....	60.0	24.0
Tensile tests as rolled and annealed:												
Elastic limit (tons)	30.1	.....	28.0	30.3	.....	28.0	28.0	32.5	.....	12.75	15.1	21.0
Breaking strain (tons)	55.1	.....	48.5	42.9	.....	40.6	42.6	46.8	.....	45.8	42.1	37.0
Extension per cent. in 8 inches	.....	.....	.....	7.5	.....	20.0	15.0	13.5	.....	29.0	40.0	.....
" " 4 "	18.7	.....	20.3	9.	.....	25.0	17.5	14.0	.....	30.0	45.3	20.0
Contraction of area per cent.	45.0	.....	42.0	12.0	.....	44.8	18.5	17.0	.....	28.6	43.6	29.0

a Test piece defective. b Too hard to machine with mushet steel; makes a fine tool, tempered a dull red in boiling water. c Too hard to machine; makes a good cutting tool when tempered in cold-air blast.

TABLE NO. 2.—TORSION TESTS of Steel alloyed with varying proportions of Nickel.

Sample number.	Number of twists in 3-inch length.	Diameter of bar one inch, lever one foot long.		Condition.	Composition.			Remarks.
		Elastic limit.	Breaking strain.		Nickel.	Carbon.	Manganese	
		Lbs.	Lbs.		p.c.	p.c.	p.c.	
1	1 7/8	857	1849	As hammered	1.0	0.42	0.58	No. 1 sample in No. 1 Table (unannealed).
2	2 1/8	677	1507	"	5.0	0.30	0.30	No. 7 " " "
3	1 3/4	665	1729	"	3.0	0.35	0.57	No. 3 " " "
4	1 7/8	621	1493	"	4.7	0.22	0.23	No. 6 " " "
5	2 3/8	553	1554	"	50.0	0.35	.....
6	3	510	1950	"	25.0	0.27	0.85	No. 10 " " "
1 A	1 7/8	697	1809	Annealed	1.0	0.42	0.58	No. 1 " " "
2 A	2 3/8	653	1485	"	5.0	0.30	0.30	No. 7 " " "
4 A	2 3/8	652	1443	"	4.7	0.22	0.23	No. 6 " " "
6 A	5	360	2100	"	25.0	0.27	0.85	No. 10 " " "
7	1 1/8	601	1689	"	.....	0.51	.....	47.2 tons per square inch (Siemen's steel).
8	1 1/8	601	1697	As hammered	.....	0.51	.....	50.4 " " "
9	3 1/8	445	1229	"	.....	.....	.....	30.1 " " "

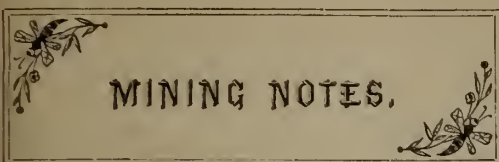
The Edward Coal Washer.

A coal washing apparatus known under the above name and which has attracted some attention abroad is described as below in the *Bulletin* of the Industrial Society of France:

"It consists of a rectangular sieve plate about 10 feet long and 3 1/2 feet wide fixed on a pyramidal hutch, having a plunger box attached to one of the long sides, and a continuous opening variable by adjustable slides for the discharge of the heavier waste on the other. The apertures in the sieve plate vary in size, the largest being nearest to the feed end. The piston, which is circular in form, and of very much smaller area than the sieve plate, is a wooden disc moved by an eccentric, and communicates motion to the water in the hutch by a cushion of air confined above the water in the piston box. The eccentric is adjustable upon its shaft so as to allow a certain variation in the length of stroke of the plunger. A clack in the disc allows air to enter if a vacuum is formed below it on the return stroke by reason of the whole of the water not being returned, as in the case of washing very fine slack containing clay, which always absorbs a notable quantity of water. The scraper frame, which is the essential novelty of the machine, is a narrow-like frame suspended by a system of jointed rods above the sieve plate, and receiving motion from a cam acting upon the counterpoised arm of an angle lever, which gives a slow forward and quick return motion. The frame, which is somewhat larger than the sieve plate, is connected at one end with the slide closing the feeding hopper, and receives a fresh portion of the material at the commencement of the stroke, which is dropped upon the plate at the coarse end, and subjected to the most energetic action of the water, while the finer portions of previous charges brought to the surface are drawn forward by the teeth projecting from the frame towards the discharging end. The length of stroke of the frame is 20 inches, so that the surface of the washed material is broken up six times in its passage through the 10-foot length of the machine. Usually the frame is suspended at such a height as to pass clear of the charge on the return stroke; but when the slack treated is very dusty, it is so adjusted that by acting on the muddy surface on the backward passage, the return of the water to the hutch may be facilitated. In the latter case care is taken to keep a depth of from 2 to 4 inches of water above the top of the charge to prevent the suspended mud from settling.

"The finely divided material accumulating as mud in the hutch is discharged at intervals through a pipe at the bottom into settling basins, and the clear water is pumped back to supply the machines. If the interior of the hutch is divided into two parts, each with a separate discharge pipe, the mud from the first is usually waste, while that from the second, being derived mainly from mixed coal and shale, is generally clean enough to be used for firing colliery boilers. When treating unclassified slack, containing all sizes up to about 2 inches, the washed material other than the fine surface coal is subjected to a final screening, giving clean coal in lumps from 2 inches to 6-10 inch; while all below the latter size is ordinary boiler slack with about 10 per cent. of ash. The fine coal raked off the top of the charge at each stroke, by the last teeth in the frame, which are deeper than the others, is received on an enclosed apron at the back of the sieve, where the bulk of the adherent water drains away, and is ultimately pushed over a shoot into a wagon placed to receive it. The stroke of the piston may be varied within considerable limits by adjusting the eccentric so as to be available for washing lumps of all sizes from 4-10 inch up to 2 inches in diameter. The number of strokes varies from forty-three per minute for stuff below 1 inch to fifty-five for larger sizes. The weight of these machines is about 6 tons each. They are arranged to work in pairs, each pair requiring a motive power of 4 to 6 horse-power, and one man to attend to them. The produce is from 12 to 18 tons per hour according to the amount of dust in the slack treated, or an average of 15 tons for two machines. They have been adopted, or are in course of erection, at six collieries in the north of France, and the basin of the Loire, four in Belgium, and three in Spain."

Lamp Cleaning by Machinery.—As a substitute for the slow and expensive process of lamp cleaning by hand, our attention has been directed to the safety lamp cleaning machine patented by Messrs. Ackroyd and Best, of Morley, near Leeds. It is claimed for this machine that it not only does many times the amount of work, in a given time, which can be done by hand, but also that it does the work better. The apparatus both draws and replaces the screws which fasten in the glass, and thoroughly cleanses the gauzes while the man or boy is cleaning the brasswork. With this machine, which is being used at some of the large collieries in the Durham, Yorks, South Wales and Wigan districts, it is stated that one man can clean over a thousand lamps a day, effecting a saving of from 35 to 40 per cent. over the old method of cleaning by hand.



MINING NOTES.

Nova Scotia.

Pictou County.

(From Our Own Correspondent.)

A good deal of lively prospecting is being done on the East River iron areas, and results, so far, have been encouraging, work on the Cameron and McColl & Son's areas opening some very promising deposits of ore.

At all the collieries in this county mining operations are going ahead briskly. The Black Diamond Colliery is the only one that is a little slack.

The opening up of the Foord pit continues smoothly. The management has put in place a very nice little blow-down, which is giving every satisfaction. The fan-shaft is being sunk through the big coal, and when this is completed places will be driven down hill for air-ways. At present they are compelled to use the pump shaft for down-cast, and hoisting shaft for up-cast.

The shipments from the Drummond Colliery for the month of July amounted to 18,000 tons, which is the largest export ever made from this colliery. For the month of August the shipments should be fully 20,000 tons, as they have double-shifted their pillar work.

Mr. John Douglas, who is prospecting for the Black Diamond Company at a point north of the present workings, has nothing new to report this month. So far his work goes to show that what he has been unearthing is nothing other than the west crop of the overlying seams of the Albion Mines.

The large hoisting-engine at the Vale Colliery, Thornburn, is to be taken down and erected at the Aeadia.

Another correspondent writes:—"You will see that the Springhill strike is ended and a victory claimed for the men, but I understand it is not altogether on one side; the practice of docking is allowed and now recognized and several matters of practice put beyond dispute. Trade here continues brisk. Our hot weather is over and the country has been made green again by frequent showers.

The location for the proposed blast furnace is still undecided, though it is generally considered that the New Glasgow Coal, Iron and Railway Company favors the site between the Foord pit and New Glasgow, offered by the Aeadia Coal Company in exchange for stock in the Com. ary.

The strike diverted but little of the Springhill trade to this county.

The New Glasgow Coal, Iron and Railway Company has a large force working on its various iron areas. At the Cameron area, at Bridgeville, two shafts have been sunk to depths of 70' and 80' respectively. The shafts are about 200 feet apart, and are connected by levels following the vein. The vein varies in width from 5' to 27', and in the most northerly of the shafts continues to give an excellent quality of ore at depth. On the McDonald property a slope has been sunk for 300' following the vein. At a depth of 75' below the crop of the ore a level has been driven 200' south and 75' north, all in ore. At 150' below the crop of this ore the second level is driven 225' south and 100' north,

in ore. Below this lower level the slope is continued for a distance of about 130', and the quality of the ore is found to improve towards the dip. The ore, however, is of an excellent quality throughout, the difference between the upper and lower parts being that there is a larger proportion of coarse ore to the dip. At Upper Stewiacke, the company has also opened a deposit of red hematite, and mined about 200 tons therefrom to date. At Brookfield, in Colchester County, operations have been continued upon the brown hematite veins occurring there, and a shaft to depth of 83' has been sunk. The crop of this vein is met at a depth of 15'. At 32', a level has been driven 150' west and 100' east, the average width of vein being about 22'. At a depth of 82' levels are now being driven, and the work so far done in them gives every indication of the vein holding out equal to that in the upper level to the west. At Black Rock, on the East River, Pictou County, some preliminary work has been done on a most promising deposit of brown hematite. Since operations were begun in July last year about 6,000 tons have been mined to date. The work is under the superintendence of Mr. R. E. Chambers.

The pay-roll of the Drummond Colliery for July amounted to \$17,000, the largest paid out in one month.

The bore-hole at the Black Diamond has been put down to a depth of 600 feet, but the results are not made public, which looks discouraging.

Cumberland County.

After nearly ten weeks strike the Cumberland Railway and Coal Company has, we understand, acceded to the demands of the men, and mining has accordingly been resumed at the Colliery. This most desirable end has been accomplished, we understand, very largely owing to the intercessions of the Hon. W. S. Fielding, the popular Premier of this Province. Commenting upon the strike and its consequences the *Journal of Commerce* has the following:—"Hardly a week has passed by that we have not had to chronicle the business difficulties of one of the local storekeepers, brought about simply from the impossibility of making sales for cash, or collecting payment for those made on credit. As a consequence the wholesale trade began in their turn to feel the turn of the screw, and thus from the pinched miner to the distant wholesaler, every link in the chain of commerce suffered from the unusual strain. If the version of the strike and its causes put forward by the miners be correct, and the fact that the company have never contradicted it would seem to indicate that it is, there were certainly grievances which the shareholders of the company should have put pressure on the management to abolish.

Press dispatches announce the sale of the Joggins Colliery to an English syndicate. We have not yet been put in possession of the particulars.

The Londonderry Iron Company is making preparations to work the extensive deposits of spathic ore at Londonderry. Gas kilns for roasting 250 tons ore daily are being erected. The old blast furnaces will be raised 15 feet, and capacity at each increased to 500 tons pig iron weekly.

A good deal of prospecting for coal is also going on in this county. The result of the work so far done at Salt Springs has not been so satisfactory as was anticipated, but Mr. Hall is still confident that he will yet strike something valuable. Mr. James Baird, manager at the Chegnecto Colliery, is also doing similar work near Maccan Station, on property owned by the Londonderry Iron Co.

Cape Breton.

Reports received here from the Nova Scotia coal mines indicate a season of unprecedented prosperity. So far the output of each mine, with the unfortunate exception of the Springhill colliery, is much larger to date than for the corresponding period last year. The shipments at the Caledonia mine, of which David McKeen, M.P., Cape Breton, is manager and director, amounted to 27,500 tons for the month of July, an average of more than a thousand tons for each working day.

Burchell Brothers, of Sydney, N. S., have purchased the Gardner coal mine. The new proprietors intend to equip and operate their mine at once. The Gardner is good coal, plenty of it, the mine well situated, and, doubtless, its present owners will take advantage of the growing demand in the Dominion and help to swell the yearly output at the Cape Breton mines by many thousands of tons.

Darr's Hill.

The Dufferin Mining Co. are pushing work in their new 20-stamp mill and hope to have it completed in September. It is intended to stamp 60 tons per day and to be more efficient than the old 40-stamp mill. The mill is modelled upon the Black Hills pattern.

Killag District.

Advices from this district state that the lode now working is looking better than ever. The quartz is from 9 to 15 inches in thickness, and will yield at the rate of 5 ounces per ton. Some of the rolls are reputed as valued at 10 ounces per ton. A level is being driven at a depth of about 30 feet to connect the two shafts. When this is completed the rich streak will be opened for over 75 feet in length. A recent break in one of the mortars in the mill prevents active crushing from being carried on immediately.

Renfrew District.

On the evening of the 11th inst. the large frame building at Renfrew, which contained the hoisting and pumping engines and air compressor of the Empress Gold Mining Co., was destroyed by fire. About six pounds of dynamite were in the building, and men were afraid to fight the fire until the same had exploded. The loss will not be heavy, as the machinery is reported as not seriously damaged. The Empress Co. is chiefly owned by Mr. C. H. North, of Boston, Mass.

South Uniacke.

The owners of the Witherow mine are doing but very little work. The main shaft has been sinking for a new pay-streak, which, at time of writing, had not been reached. The Thompson Co. continues to mine very small lots of very rich quartz. It is reported that the pay-streak has run out on one end of this property though still good on the other and.

Some Halifax men have been prospecting the property east of the Thompson line, but have, as yet, no results to make public.

Montague District.

The cessation of work upon the Rose Lode here, which took place some months ago, was not unexpected by parties familiar with the lode when it was working some years ago. The pocket from which the rich quartz was milled last winter is said to have been only a fragment of the rich streak formerly worked, and the continuation of the streak beyond the break is yet to be found. With skilful management and a little capital expended in dead work this continuation should be found without difficulty.

Central Rawdon District.

Several falls of rock in the workings of the Northrup Mining Co., limited, are reported. So far, they have occurred chiefly in the older part of the mine, and the old shaft is reported as closed up. The wall rock slacks and swells very rapidly upon exposure, entailing constant watchfulness upon the management.

Colchester County.

The Colchester Coal Mining Company have done some preliminary work on their area at North River, above Onslow. The indications are so encouraging that arrangements are now being made for new machinery plant for more extended working. About 100 feet of a slope is now completed, with a gin for hoisting, double track, trolleys, etc. Up to the 1st of the present year about \$1,500 have been spent in development.

In General.

The next regular monthly meeting of the Gold Miners' Association of Nova Scotia will be held at the Halifax Hotel, on Friday afternoon, the 5th September, at two o'clock. A large attendance of members is particularly requested.

The property and machinery plant of the Brunswick Gold Mining Company will be sold at public auction by the sheriff, at the County Court House, Halifax, on Saturday, 13th September next.

The Stanley Gold Mining Company are applying for incorporation. Capital, \$40,000; head office, Westville. Directors: John McDougald, M.P.; John Bryson, M.P., and Duncan McGregor. The company's property is at Fifteen-Mile Stream.

The Lawson Antimony Mining Company are also seeking incorporation. Capital, \$50,000; chief place of business, Halifax. The directors include Robert McNaughton, Truro; B. F. Pearson, and Charles Annand, Halifax. The properties to be acquired and worked are in the Rawdon District.

Quebec.

The output from the mines of the Johnson's Asbestos Company, Limited, at Thetford, for the present year promises to be between 1,200 and 1,500 tons, No. 1 and No. 2 quality. At date a little over 2,000 tons of No. 3 are on hand.

A correspondent from the Beauce district sends the following: "Gold mining in this district has been very quiet, due, I expect, to the failures of the Colonial Gold Mining Company, and the Gold Mining Association of Canada, and this, not because the gold is not here, not

Gold Mining Supplies.

The principal depot in Nova Scotia, carrying the most complete assortment of first class goods, is

H. H. FULLER & CO'S

41 to 45 Upper Water St., Halifax, N.S.

Our line comprises Explosives, Fuse, American and English Mill and Hammer Steel, Bar and Bolt Iron, Steel Wire Hoisting Rope, Hemp and Manilla Rope, Rubber and Leather Belting, Miners' Candles, Oils and Lamps, Miners' Tools, Machinists' Tools, Blacksmiths' Tools, and every requisite for the gold miner.

H. H. FULLER & CO.,
Halifax, N.S.

because there is great difficulties in the way of its extraction, but simply because of excessive extravagances on unnecessary works and methods of mining. In prospecting the property of the former Company, which I have since purchased, I discovered an old river-bed in the hill called 'Jersey Point', at the juncture of the DuLoup and Chaudiere rivers, and from one pan of dirt I found a pennyweight of gold. I have also found a quartz vein carrying free gold. There is no quartz-mill or crusher in this district, and as I think they are greatly needed, I am prepared to make any arrangements with any company that will come and put one up. Any company favorably disposed to do this would receive encouragement from our municipality in the way of a remission of taxes for a number of years."

Eastern Townships District.

The Memphremagog Mining Company purpose erecting shortly a smelting plant to treat the ores from their mine in the Township of Potton. A small force is employed opening out the property, and a large quantity of ore will not be raised until the smelter is in place. It will be remembered that this company mined an output of some 2,000 tons last year.

BELL'S ASBESTOS COMPANY, LIMITED.—The directors have declared an interim dividend of 10s. per share (free of income tax) for the half-year ending June 30 last, being at the rate of 20 % per annum, payable by warrant on the 31st inst. to the shareholders on the register on the 26th inst.

The shipments of copper ore from Capelton Station, from 1st January to date, amount in the aggregate of 27,571,400 lbs., or a little over 13,785 tons.

Ottawa Valley.

The shipment of phosphate from the mines of the Canadian Phosphate Company from opening of navigation to date have been :—

No. I.—(80 to 85%.....)	1,338 tons.
" II.—(70 to 75%.....)	1,864 "
" III.—(60 to 65%.....)	506 "
	3,708 tons.

At the Aetna Hill and Lansdowne mines, operated by the Anglo-Continental Guano Company, under direction of Mr. J. B. Smith, considerable activity is manifest, and the shipments for the year are expected to be figure close upon 3,000 tons.

The completion, or rather the non-completion of the works at Little Rapids, is again causing great trouble and inconvenience to the miners on the Lievres. Two scows, belonging to the Canadian Phosphate Company, had the misfortune to get on the rocks at the rapids this week, and suffered considerable damage thereby. The Department of Public Works promised that the work should be finished this year, but judging from appearances it will probably be a couple of years yet before this bugbear is removed.

The new Ingersoll plant for the High Rock mines will be in running order by the end of this week. Mr. Pickford, sr., from London, Eng., is expected at the mines next month.

Mr. C. C. Hoyer Millar, of the firm of Couper, Millar & Co., London, Eng., will also visit the mines of the Can. Phos. Co. in September.

The boom in "prospects" and other properties held for speculative purposes, consequent upon the exaggerated ideas formed of the operations of the Phosphate Corporation, is dying out. Properties held a few weeks ago at chimerical figures have now lapsed into their old groove.

The Templeton mine-managers complain of the scarcity of labor, miners being difficult to get.

Prices continue good, and the prospects of a busy season are bright.

Ontario.

Port Arthur District.

(From Our Own Correspondent.)

THE CROWN POINT MINE.—A one-half interest in this property has been sold by Messrs. Cummings and Montgomery to H. R. & E. Tinkham, Hon. O. P. Stearns, Hon. J. D. Ensign, Geo. Elder, James Billings and C. E. Shannon, all of Duluth, Minn., the consideration being \$100,000.

The property is situated in the township of Lybster, about forty miles from Port Arthur. It is composed of location R95 and comprises 160 acres; it adjoins the Shuniah Weacheu Mines Company's property and the West

End Mining Company's land on the north. The location is traversed by three strong well-mineralized veins. No. 1, or the main vein, which is a true fissure, causing a fault of 9 feet, outcrops for three-quarters of a mile; it has a general east and west strike, and dips southerly about fifteen degrees; its average width is four and one-half feet; the vein gangue is composed of calc spar, fluor spar, zinc blende, and a small quantity of galena. It carries silver in the form of argentite and native, giving good results wherever opened, the lowest results from milling, ore giving 25 and the highest assays of smelting ore giving 2,980 ounces of silver to the ton of 2,000 pounds.

Nos. 2 and 3 veins outcrop on the top of the mountain and extend down over the east and west slopes respectively. They have the same general strike and dip as No. 1, and give every promise of turning out as well as it did on development, surface specimens taken anywhere on the vein, giving good assays in silver. The gangue has the same characteristics as No. 1.

The work done up to date consists of the following :—No. 1 adit level on No. 1 vein was started in 90 feet from the top of the mountain, some distance below the trap, and has been driven in on the vein for a distance of 150 feet; good milling and smelting ore was taken out of this level for its entire length.

No. 2 adit on No. 1 vein was started in at a point 65 feet below No. 1 adit and has been driven in a total distance of five hundred and seventy-eight feet on the vein. At a point four hundred feet from the mouth of No. 2 adit a winze has been sunk to a depth of forty-four feet; one hundred and forty feet in on No. 1 adit a winze has been sunk to connect with No. 2 adit. Another winze has been started near the breast of No. 1 adit and is now at a depth of 20 feet. There are five cross-cuts from 16 to 20 feet in length driven at different points on the levels. On the westerly end of the outcrop, about three-quarters of a mile from the workings described above, an adit has been run in on the vein for a distance of sixty feet; these workings are all below the overlying trap and in the Animikie slates. The vein has been left standing in the last one hundred feet of No. 2 adit, and a conservative estimate of the amount of ore in sight at this point places it at seventy-five tons of smelting ore that will average 400 ounces to the ton of 2,000 pounds.

There are 1,400 tons of good milling ore on the stock pile that gives average assays of 50 ounces to the ton.

During 1889 they made several shipments to Duluth smelters, some of which gave an average value of 852 ounces to the ton in silver. I have been unable to ascertain the quantity shipped, but one lot shipped on Sept. 19th, 1889, consisted of 17 tons.

The new company proposes to push development work with all possible despatch, and have decided to build a branch railway, one mile in length, to connect with the Port Arthur, Duluth and Western Railway. I understand it is the intention of the Shuniah Weacheu Mines Company to join them in the construction of this branch. This will give them first-class facilities for the transportation of supplies, machinery and ore. They also propose to erect a concentrating plant of fifteen head of stamps with power sufficient to run twenty-five head power drills, and a compressed air plant will be placed in position as early as possible.

It is also their intention to start another adit seventy-five feet below No. 2, which is designed to be the main working level of the mine. It will give them about 230 feet of back ground. Very little hoisting or pumping will be required for some time, as the workings are all above the common level of the country.

The force of miners will be increased as fast as men can be secured, and an early development of this promising property may be looked for, and from the developments already made it is reasonable to expect that future operating will give satisfactory results, and that the Crown Point will add one more to the famous silver producers of the Port Arthur district.

Messrs. Cummings and Montgomery are to be congratulated in securing the co-operation of such influential and wealthy gentlemen.

THE MOCAN VALLEY GOLD LOCATION.—This property is situated in the district east of Port Arthur, 3½ miles north of the Canadian Pacific Railway, at Jackfish Bay, Lake Superior. It is easily accessible from either the lake or railway, through the Mocan Valley, which is quite suitable for either a waggon or tramroad. The north end of the location borders on Mocan Lake, a deep clear body of water, about half a mile in length. The outlet is fourteen feet in width, and passes directly through the location, near the works on the vein. It makes a descent of 40 feet above and near the works referred to, and will give an excellent supply of water for all mining purposes. The creek lies in a valley that occupies the western portion of the location, the mountains rising on either side to a height of about 200 feet. The location and vicinity is well supplied with timber suitable for mining purposes.

The rock formation consists of the Huronian diorites

and chloritic schists, striking east and west, and dipping with a high inclination southward, with an occasional syenitic vein penetrating it from a great granitic syenite belt, which bounds it on the south side within a few hundred feet of the location. Several quartz veins intersect the location, two of which carry free gold. One of them, which may be said to be the main vein of the location, is in about the centre of the property, striking eastward across the mountain from the above-mentioned valley. It has been exposed in several places, over a distance of about a thousand feet from the foot of the hill, up the face and back on the summit. It is a strong fissure vein, from 2 to 6½ feet wide, of quartz, with an inch of clay on the foot-wall in the tunnel.

The tunnel was driven in on the vein for thirty feet at the foot of the mountain, twenty-five feet above the level of the valley. The vein here is four to seven feet in width, and carries considerable auriferous pyrites, assaying \$22 in gold per ton of 2000 pounds. On the surface, about fifty feet further east, the vein carries free gold, and it is expected that if the tunnel was driven in to cut that point it would show free gold also; in fact a few colors were shown in the last blast put into the tunnel. The vein in the tunnel dips 60° to the south. Thirty-five different tests have been made on this vein, in pulverizing, roasting and washing, and with few exceptions turned out a good showing of gold dust in the pan. A test of 1290 pounds, made by the North-Western Reduction and Chemical Works, of Chicago, of the rich part of the vein, gave an average of \$41.34 in gold to the ton of 2000 pounds. Assays from other parts of the vein, by C. Kreissman, M.E., of Port Arthur, gave an average of \$20 in gold to the ton of 2000 pounds. The second vein bears N.N.W., dips westward 30° to the horizon, and lies about fifteen chains to the east of the tunnel, and will interest the main vein. It is three feet wide, and is composed of decomposed quartz. No assays have been made from this vein, but it shows free gold in considerable quantities by panning.

The district east of Port Arthur is attracting the attention of explorers to a greater extent this season than ever before. Some very promising gold, silver and nickel properties have been located in the vicinity of Schreiber.

CLOUD LAKE SILVER LOCATION.—This property is situated on the north-east quarter of Lot 5, Concession 2, in the township of Crooks. The title has been in dispute for about a year, owing to rival claims made by different explorers. In April last the Ontario Government issued a Commission which held sittings in the court-house at Port Arthur. A mass of evidence pro. and con. was submitted during ten days. The commission reported some time since and the Government have finally decided to give each of the two claimants an undivided one-half interest in the property. The location comprises 174 acres and is traversed by two strong, well-defined and heavily mineralized lodes. No. 1, or the main vein, has a general north-east and south-west strike, with an average width of 5 feet and can be traced for one thousand feet. No. 2 vein has an east and west strike with an average width of four feet; it joins No. 1 about the middle of the outcrop; from the point of intersection eastward as far as the vein is exposed it has an average width of 8 feet. A shaft 12 feet in depth has been sunk at the contact of the two veins. The lowest assays from rock taken taken out of the bottom of this shaft, showing no silver, was \$300, and the highest from rock showing argentite, zinc blende and galena was \$2,900 per ton. Development work has been commenced and good results may be looked for.

TERRACE BAY GOLD MINING COMPANY.—This company's property comprises 1,600 acres and is situated on the shore of Terrace Bay, a few miles west of Jackfish Bay, Lake Superior. Mr. Roland, M.E., who has lately made an examination of the property for the owners, found it to contain several well defined and highly metalliferous lodes. The geological formation prevailing throughout this tract generally is Laurentian; occasionally as towards the northern and eastern limits rocks of the Huronian age are encountered. The gauge of the veins, as far as tested, consists of fine quartz, of a granular, and in places vitreous, texture and appearance, carrying chalc pyrites, highly auriferous, argentiferous galena, and molybdenite, while the walls are invariably slicken-sided with pyro-schist, the matrix being occasionally streaked with red orthoclase. An average of twenty-five pounds of this chalc-pyrites yielded by assay \$13.50 per ton of 2,000 pounds. The principal testing work was done on location No. 4 where, on a strong well-defined lode, bearing north nine degrees east, a drift was run in 45 feet. This lode is joined at intervals of about ten feet with heavy mineralized "feeders" from the south and east. The lode improved very fast, as the drift was driven in on it. The concentrates from the ore taken out give excellent result. I believe it is the intention of the company to proceed with the development

of the property. It is splendidly situated; the Canadian Pacific railway runs through the property and the harbour facilities are of the best.

THE BEAVER MINING AND MILLING COMPANY.—This company shipped two carloads of smelting ore and concentrates on the 2nd inst. to Messrs. Balbach & Sons, Newark, N. J., valued at \$40,000. Capt. Hooper expects to be able to ship from \$25,000 to \$40,000 monthly, and taking into consideration the amount of ore on the stock pile and the developments made in the mine, it is quite reasonable to expect that he will be able to do so. New ground will continue to be opened up and the extent and number of the veins on this property gives them great opportunities for work of this kind. They have at present on hand at the mill and ore-house about two carloads more that will be shipped shortly.

THE BADGER SILVER MINING COMPANY.—This company shipped 17 tons of smelting ore and concentrates on the 4th inst. to Geo. W. Robinson, 91 Wall street, New York, valued at \$37,000. This is the product of No. 2 vein since its discovery on the 8th June. Superintendent Shear says he can guarantee shipments of \$55,000 monthly from the Badger property this year. Everything is going on very smoothly. They have 480 feet of ground opened up on No. 2; it has become richer at the west end than at any point yet opened. Several stringers came in from 75 to 100 feet west of the shaft, everyone of which was literally filled with argentite. A Cunningham twin engine, friction drum steam hoist has been placed in position at No. 3 shaft. An adit level is being run in to cut the vein 60 feet below the bottom of No. 4 shaft in the slates. Good milling ore, assaying from 100 to 150 ounces of silver to the ton, is being taken out of No. 3 adit and shaft. Drifting is being pushed on the west end of No. 1 vein. The vein is widening out and becoming stronger as the drift is driven in. Some of the ore is very high grade, going up to 700 and 800 ounces to the ton, the average of the vein is about 125 ounces, and from all appearances it will improve very shortly. The mill is running full blast night and day, treating 35 tons daily.

THE WEST END MINING COMPANY.—This company's property has been sold to Elias F. Drake, of St. Paul, Minn., representing a syndicate of wealthy capitalists, for \$150,000 cash.

It is situated in the township of Lybster, and adjoins the Shuniah Weachu Mine Company's property. It comprises 240 acres. There is a steam hoisting and pumping plant, and about twenty buildings, including superintendents' residence, store, blacksmith shop, boarding house, miners' dwellings and ore house on the property.

The location is traversed by four good veins, and with the exception of some surface work, only one of them has been developed. It is a true fissure vein, averaging six feet in width. It outcrops on the Shuniah Weachu Company's land, and is exposed clear across the West End Mining Company's property, carrying a uniform width throughout; the entire length of this vein on the property is slightly over half a mile. It is very rich in silver, carrying it in the form of native and argentite and highly argentiferous zinc blende, the vein matter giving assays from 40 to 5,000 ounces to the ton of 2,000 pounds. In October, 1889, the writer saw 26 bags of ore taken out of the cross-cut, mentioned below, that would average not less than 7,000 ounces to the ton, principally native silver.

So far the work on the property has been confined to development, no stoping having been done. The object of Mr. H. N. Nichols, a thoroughly practical mining man from Denver, Colorado, who has been superintendent, has been to open up, and place the property on a good paying basis, before attempting to take out any ore, other than what was encountered in the course of development work.

The work done consists of the following: No. 1 shaft has been sunk to a depth of 225 feet, 75 feet down levels were run east and west 175 and 100 feet respectively. 140 feet from the surface the second set of levels were driven east and west 75 and 50 feet on the vein. No. 2 shaft is 65 feet in depth, and drifts have been driven each way on the vein for a distance of 125 feet. No. 3 shaft has been sunk to a depth of 50 feet, and No. 4, which was commenced a short time since, is 15 feet in depth; in addition to the shafts winzes have been sunk between the levels in No. 1 shaft, and a cross cut has been run into the face of the bluff to intersect the vein east of No. 2 shaft, and a drift, 125 feet in the vein from breast. The cross cut workings are all No. 1 vein, and the shafts are 650 feet apart.

In the course of this development work 15 tons of smelting ore has been taken out and shipped to Denver smelters, and the stock pile contains about 2,000 tons of good milling ore, 1,000 tons of which will average about 100 ounces to the ton, and the balance 40 ounces to the ton. I understand that it is the intention of the new owners to put a large force of men at work and develop

the property on a large scale as soon as the railway reaches that point, which will be about December next, a large concentrating plant will be erected.

(Later Correspondence to the Review.)

THE BADGER SILVER MINING COMPANY.—In No. 2 shaft sinking has been resumed below No. 1 level, and a winze is being sunk 175 east from the shaft. Drifting still continues west on No. 1 level. All these workings are being done on the vein, which continues just as rich as when I reported it last. The new steam friction drum hoist is now in place at No. 3 shaft and is giving excellent satisfaction. No. 1, or the lower adit level at this shaft, is now in a total distance of 300 feet, 90 feet of which has been driven since the Badger Company acquired it. This property (Porcupine), the whole of this distance has been in good pay ore and has steadily increased in richness, the last 30 feet being all bonanza ground. The vein is strong and regular with an average width of 3 feet. The gauge of the vein is principally calcite, carrying both native and black silver. On the hanging wall there is a band of witherite varying in thickness from 2 to 8 inches, and very rich in argentite. This band appears to continue through the hill, as they have the same streak in the shaft 500 feet east from the breast of the level. Sinking was commenced last week in the shafts. They have 14 feet more to sink to reach the depth of No. 1 level, at which point drifting will be commenced to connect through to the level. There is every reason to believe that the rich body of ore they now have in No. 1 level continues through to the shaft, as the bottom of the shaft is now in bonanza ground of identical character.

Drifting is being proceeded with at the west end of No. 1 vein. The vein is becoming stronger and better defined, carrying good pay ore all the way. The mill is kept going night and day. Another large shipment of high grade smelting ore and concentrates will be made in a few days. Geo. W. Robinson, of New York, general manager, and one of the principal owners of the property, visited the mine this week in company with his family. The Badger stock, which has a par value of \$5, sold one month ago for \$6, cannot be purchased now for less than \$22, and most of the holders refuse to part with it for less than \$50 per share.

Numerous sales of mining locations have been made within the past few days in the silver district, the early event of the railway, no doubt, is the principal cause of the movement. Intending investors would do well to secure lands now, as when the railway is completed to Whitefish Lake it is bound to increase the value of mining lands, and consequently the price at which they can be purchased.

A. P. Bliss, of Saginaw, Mich., who purchased the Palisades location for \$10,000 and has since refused \$20,000 for it, purchased on the 13th inst. R. 58 and R. 59, containing 80 acres each, entirely undeveloped, lying immediately west and east of West End mine and Shuniah Weachu mine respectively, for \$40,000 cash. Two days after the purchase he refused an advance of \$3,000 on the price he paid. It is his intention to place all these properties under development early in 1891. R. R. Paulson, the iron king of this district, purchased R. 255 for \$1,000 cash, an 80-acre location lying west of Sand Lake, on which there is a good silver vein and a very promising outcrop of iron, both of which are developed. Two silver locations, lying north of Whitefish Lake, in the Township of Strange, were sold last week for \$300 and \$500 each, and changed hands in a few days at an advance of about 500 per cent. each. Numerous other transactions in mining lands are on the tapis, some of them involving large amounts of money are reported, and while it cannot be said to be a boom, it is safe to say that it is the legitimate outcome of the rich and satisfactory developments already made in the district, and which will soon be increased by the facilities afforded by the railway.

Capt. Wilson has had a gang of men out testing R. 366 lying a short distance north-west of Sand Lake, and reports having found leaf silver in the gneiss, which at that point is 11 feet in thickness. He has great faith in finding good silver in this formation, and his results so far certainly appear to bear him out. No work of any consequence has been done in ground of this kind in this district, and therefore his theory cannot as yet be disproved. His work will be watched with great interest, as this formation joins the "Animikie" slates on the north-west.

THE SILVER ISLET CONSOLIDATED MINING AND LAND COMPANY.—Capt. T. H. Tretheway began operations on the 13th inst. at the new parallel vein on Edward's Island. A shaft will be sunk on the vein to the point of intersection of the old or No. 1 vein. It is expected that a rich body of ore will be struck at this point, as both veins carry silver in good quantity on the surface. The dip of each will bring them together 75 to

100 feet from the surface. No. 1 carries arsenical ore, giving assays from 150 to 700 ounces of silver to the ton of 2,000 pounds. Their property at Cap en Gargantua has been re-surveyed. This is the property that has the manganese vein, averaging 10 feet in width and standing up like a dyke over the surface of the ground. At the time of discovery, about two months ago, average samples from the surface of the vein were assayed by Chas. Brent, M. E. Port Arthur. They gave an average of 39.80 % manganese. Check assays made for the company in New York gave a somewhat higher percentage in manganese. This property will be thoroughly explored by means of a diamond drill and sinking a number of shafts at different points on the vein. The Cape Maimase lands will also be thoroughly explored and tested. It is expected that this company's operations will assume large proportions very shortly. Mr. H. S. Sibley is expected here about the 25th inst. He will be accompanied by an expert, who will examine and report on some of the company's lands.

THE ELGIN GOLD MINING COMPANY.—The property of this company is situated at Jackfish Bay, Lake Superior. Some development work was done there in 1884-5, which gave very satisfactory results. The vein carries free gold and highly auriferous pyrites. Capt. J. H. Dickie commenced operations on the 4th inst. with a gang of ten miners to open up the old works and drive a new drift in on the vein. The Canadian Copper Co. of Sudbury are largely interested in this property, and if Capt. Dickie's report is favorable, smelting and concentrating works will be erected and the property worked on an extensive scale.

Lake of the Woods District.

Owing to the delay in the completion of the new Reduction Works a petition is being circulated for signature in Rat Portage for the forfeiture of the bonus promised by the town. The postponement of the completion of the works is due, in large measure, to the difficulties experienced with the customs officials in passing in the machinery plant, to which reference was made in our last issue.

Sudbury District.

The production of copper and nickel ore from the mines of the Canadian Copper Company for last year is officially stated to have been 60,000 tons. No. 1 furnace was blown in for the first time on December 24th, 1888, and ran from that time to December 31st 1889, 259 days of 24 hours, using 31,268 tons of ore and producing therefrom 3,849 tons of matte, averaging probably about 18 per cent. copper and 13 per cent. nickel. In this operation there were consumed 3,950 tons of Connellsville coke, costing about \$6.50 per ton at Sudbury. Smelter No. 2 started September 4th, 1889, and ran 73 days from that period to December 31st, using 9,740 tons of ore and producing 1,210 tons of matte, averaging probably about the same per cent. copper and nickel as No. 1. This furnace consumed 1,169 tons of coke. Shipments have been made to Philadelphia, New York, Swansea, Liverpool and Hamburg. Coke is shipped by boat from Cleveland to Algoma mills, and thence over the Canadian Pacific Railway to Sudbury. The shaft at Copper Cliff Mine is sunk at an angle of 45°. On the 31st December, 1889, it had reached a depth of 502 feet, and the width of the ore deposit at that depth was 65 feet; the present depth (on slope) is about 458°; about 300 men are employed.

The Dominion Mineral Company's smelter has had to be shut down, their supply of roaster ore having given out.

The smelting works recently erected by the Vivians, of Swansea, will soon be ready to treat ore from their mines.

Kingston District.

(From our own Correspondent.)

At the pits of the Foxton Mining Company, after having done almost nothing but "dead work" since the beginning of the year, a large body of high test phosphates has again been struck, and the output has consequently very materially increased. The force will be increased to 45 men.

At the "Orser" phosphate mine, 11, 11, Loughboro', five men are employed. The output is as yet slow, a good deal of time being taken up in opening, as it is a new mine. It is intended to largely increase the force after harvest. The prospects are very good here.

The Sydenham M. & M. Company opened in spring a new phosphate property on 12 in 8th con., Loughboro'. It was not successful at first. About two months ago they struck a very large vein, and since then have taken out about 250 tons. 17 men are now employed. When some "dead work" now being done is finished, it is expected that a good output will be made.

Fred. Foxton is opening on W. $\frac{1}{2}$ 5, in the 8th, Loughboro. Not much done yet.

Rock Lake Mine, (Bell & Claxton.) Some time ago water got into the large pit—beyond control of the machinery at hand—and work had to be abandoned there for the present. It is intended to remedy that immediately by putting up a powerful plant, &c. Eight or ten men are working in small pits. 422 tons of phosphate have already been shipped this season, and about 100 tons are lying at the mine ready for shipment.

Messrs. James Richardson & Sons, Kingston, expect to ship at least 4,000 tons of phosphate this year.

The Sydenham Mica and Mining Company have now employed at their mica mine near Sydenham (lot w. $\frac{1}{2}$ 11 in 7th con., Loughboro) 15 men. The shaft is now 160 feet deep. At their shop in Sydenham, where the mica is cut, 12 men are employed. At their white mica mine in Effingham they employ 10 men.

Webster & Co. have discovered and opened a dark mica mine on 16 in the 9th, Loughboro, the lot on which is situated the old Frontenac Lead Mining Company's works. Five men are now employed. The mica is said to be of very good quality and abundant.

Fred. Foxton is opening a mica mine on W. $\frac{1}{2}$ 5 in the 8th Loughboro. The mica is good, but the productiveness has not yet been ascertained.

Chas. Orser is opening on 11, 11, Loughboro, where the mica is also good, and indications point to its being in quantity.

In General.

The Haliburton Mining Company, owning some 1,200 acres in the 11th, 12th and 13th Concessions of Lower Monmouth, has a small force prospecting under superintendence of Mr. F. S. Miller. Some promising deposits of phosphates have, we understand, been opened up.

The Premier Oil Company, which recently purchased the plant of the Producers' Refining Works at Petrolia, give notice of application for incorporation. Capital stock, \$150,000. The directors of the new company are Wm. Brough, Toledo, Ohio, S. Cunningham, Washington, Robert Reid, Montreal, R. K. Thomas, Montreal, and R. Menzie, Petrolia. New underground tanks have been constructed, pipe lines laid, new condensers and stills erected, and many other improvements in the way of buildings, water works, increased facilities in every department, etc., are under course of construction. Another month will probably see the completion of the firm's proposed works, when the whole will be immediately put into operation. Among those interested are capitalists from Pennsylvania, Ohio and New York.

The Frontenac Phosphate Company, recently organized, is equipping its mine with a new machinery plant. The shipments of the company will be made per Messrs. Millar & Company, Montreal.

The Citizens' Natural Oil and Gas Company, of Kingsville, Ont., struck a fine flow of natural gas in their well near that town a few days ago. This well is about 300 feet from the great gusher No. 1 of the Ontario Natural Gas and Oil Company, and about the same depth—1,020 feet. It is estimated that the flow of gas will be about 15,000,000 cubic feet a day.

Manitoba and N. W. T.

Mr. Geo. H. Campbell, President of the Manitoba Railway and Coal Company was in Ottawa during the month, negotiating with the Department of the Interior respecting the land grant to his company. This company is the owner of some 2,000 acres of coal lands near the town of Deloraine, upon which some satisfactory prospecting has recently been done. A number of test pits, and a shaft to a depth of 60 feet, have been put down, giving abundant evidence of a profitable output when mining operations proper are begun. Mr. Campbell estimates that the company, when in working order, will be able to place about 50,000 tons of coal on the Manitoba market. Arrangements are being made for the immediate construction of the company's railway from the mines to Deloraine, and from thence to the city of Brandon, a distance of some 70 miles. The coal seam averages 7 feet, and, judged by recent analyses, is of good quality.

A meeting of the Canadian Anthracite Coal Company was held at Ottawa during the month, when it was decided to increase the present capital stock of the company from \$500,000 to \$1,000,000. Operations at the mines are to be resumed at once.

At the mines of the North-West Coal and Lumber Company at Canmore a good deal of activity has been manifested lately.

Mr. Brinkenhoff, the discoverer, and one of the original owners of the coal mines at Canmore, passed through the city on Saturday on the way to St. Paul to visit his family, after spending seven months in the mountains. An English company, known as the North-West Coal and Lumber Syndicate, has purchased the property above referred to, but Mr. Brinkenhoff still retains an interest in it. He says that two cars are now being loaded with coal, which is to be sent to Winnipeg to be tested, and it is expected that shipments will be made regularly afterwards. The mine will be operated as vigorously as possible. Mr. Brinkenhoff says that coal companies in the west labor under a disadvantage owing to the distance of mines from the chief markets and high railway rates, but he hopes to see the latter difficulty removed ere long. As the people in the smaller towns along the lines of railway are beginning to use coal as fuel, the consumption in this country is gradually growing, and must soon reach great proportions.

British Columbia.

The miners at the Wellington collieries are still out on strike, the men refusing to work because the Dunsmuirs, who are the owners, would not give consent to the following demands:

"First—To work eight hours from bank to bank.

"Second—Recognition of their men as a union.

"Third—And their committees be empowered to investigate in all differences between employer and employees."

Commenting on the matter the *Colonist* has the following pertinent remarks:—"The eight hour shift has obtained in Wellington for years, but the time is counted from the hour in which they actually begin work until the hour they leave off. What the miners wanted was to have the day's work to begin when they were on the bank ready to go down into the mine, and to end when they were on the bank again in the evening.

"These conditions may be of importance to the miners, but the question is whether those whom the miners looked up to for guidance and advice were warranted in urging them to strike if they were not conceded. They knew, if the miners generally did not realize it, what a lengthened strike involves, and granting that the men would be benefited if they obtained what they wanted, was the good to be gained of sufficient importance to justify so extreme a measure as a strike in order to obtain it?"

The Revelstoke Mining Company, organized in London, Eng., early in the present year, is reported to have recently acquired the No. 1 and "United" mining claims, as well as a two-third interest in the "Great Eastern" and one-half interest in the E. W. R. The No. 1 was bought from Velnoweth and Duncan for \$15,000, and the E. W. R. and Great Eastern from the same parties for \$1,000. The United was got from Hugh and Tom McGovern and James E. Dolan for \$7,500—the total purchases amounting to \$23,500. These investments were made with the object of supplying the Revelstoke smelter with ores from the Hot Springs district of Kootenay Lake. The No. 1 has already made a record as an ore-producer, it having been under bond to G. B. Wright, who is said to have shipped \$25,000 worth of ore from it in 1888, and fully as much has been expended on it in development.

From all reports it would seem that West Kootenai will be represented by a first-class mineral exhibit at the Toronto Exhibition next month.

The Island Mountain Mining Company, located near Barkerville, B.C., has its mill nearly completed, and will commence crushing in a few days.

Mr. Lyman Banks, representing eastern capitalists, has bonded 7,000 acres of coal lands at Fort Rupert, Vancouver Island. He has also purchased in the States a diamond drill with a complete outfit of mining machinery. Mr. Banks left on Friday by steamer *Boscovitz* for Fort Rupert. He was accompanied by a party of experts, and boring will be prosecuted at once with every prospect of success.

At a recent meeting of the Crow's Bar Mining Company it was estimated that the preliminary expenditure on the company's claims would not exceed \$6,000. The water will be brought from a height of about 3,000 feet above sea level and traverse about 18 miles of country through ditches and lakes, with a final fall of about 2,000 feet through a ditch about 12 miles long, of which nearly four has been already constructed.

The establishment of mining associations in different parts of the Dominion is a feature in the development of our industry which cannot be too highly commended. When properly conducted these excellent institutions have proved of great mutual benefit, and have exercised a most wholesome influence on many public questions affecting the welfare of the miner. Were there more of them in our mining districts there would be fewer objectionable features in mining laws; the prohibitory effect of our tariff on imports of mining machinery would be diminished, if not abolished; there would be less booming and misrepresentation, and more vigorous development at our mines, and the industry all round would be in a much more prosperous condition. The latest acquisition, which we heartily welcome to the ranks of those already organized, is the Miner's Association of Revelstoke, B.C. As the Executive Committee state in an address appended to the constitution of this new association, experience has shown that action on the part of the miners of British Columbia is absolutely necessary in order to prevent legislative measures which, if passed, are calculated to inflict serious injury to the mining interests of that Province. We wish the association every possible success.

Our Portrait Gallery.

Owing to business changes our engravers are unable this month to furnish our readers with the portrait for our fifth sketch. The series will, however, be resumed in our next issue and continued regularly thereafter. The subject of our next sketch will be that of Mr. John Bowron, Gold Commissioner for the Cariboo District, British Columbia.

Lake of the Woods Gold District.—W. Roland, C. and M.E., has just returned from making an examination of the Stewart locations, Nos. 250 P and 288 P, situated on the line of the Canadian Pacific Railway at Rossland Station. The property comprises 220 acres, and is traversed by three veins, two of which are exceptionally well defined. The veins have a general north-east and south-west strike. The country rock is of the Huronian series. Several test pits were sunk under his supervision, at intervals, on each of two of the veins. Average samples were taken from these pits, and gave the following results on assay by Chas. Brent, M.E., Port Arthur:—

Sample No. 1,	4.89 ozs. gold
" " 2, from hanging wall	5.32 " "
" " B, from most southerly point	3.48 " "
" " 4, from most northerly point	6.92 " "

Check assays made by Prof. Heys, Toronto, gave:—

Sample No. 1,	4.65 ozs. gold
" " 2, from hanging wall	5.48 " "
" " B, from most southerly point	3.42 " "
" " 4, from most northerly point	7.00 " "

Concerning Belgian Miners.—A correspondent of the *Leeds Mercury* writes as follows: "Mr. T. Lindsay Galloway, M.A., F.G.S., some time since paid a rather lengthened visit to several of the principal European coal mining districts, including a number in the north of France, Germany, Austria and Belgium, and he embodied what he had seen in an interesting paper read before the North of England Mining Institute. The mines of Belgium, he states, are a prolongation of those in the north of France, and, owing to the strata upon the southern side of the basin being literally crumpled into folds, there is great scope for the resources of the art of mining. At the Product mines, in the vicinity of Mons, females are employed, as is the case at the mines generally in Belgium. The men work in companies of five or seven, and are attended by two females, known as the *bouteur* and the *chargeur*. The *bouteur* is generally a young girl, who collects the coal into a heap at the rail ends, which the *chargeur* fills into tubs. The females are dressed in jackets and trousers, the younger ones working from 4 a.m. to 3 p.m. which is the same shift as the hewers, being eleven hours.

A Seller's Regrets.—The *Coal Trade Journal* states that about two months ago William Moore, of Scranton, Pa., sold 100 acres of land situated in Dickson borough, just across the city line, to Messrs. Benner, Watkins and Williams, coal operators. The price was \$25,000. Soon after the land had been deeded over the owners erected a McEthen mine drill upon the place and in a few days the huge auger was penetrating the bowels of the earth. This set Moore to thinking, and two weeks ago he sought the coal operators and offered them \$30,000 to sell back, but the offer was refused. Recently the drill broke through a vein of coal 10 feet thick at the depth of 150 feet. The coal is of the finest quality, and there are "millions in it" for the new owners. The value of this land now is estimated at over \$1,000,000. This opens up a new coal sub-field, and in a locality where the presence of coal was not even suspected.

Improved Bee-Hive Coke Oven.

John Fulton, M. E., Johnstown, Pa.

The general plan of the bee-hive coke oven has held its place in the manufacture of coke with great firmness. It is venerable with age, and indeed has been sneered at because of its antiquity. Notwithstanding all this, it has kept quietly on its way, producing the very best possible coke from the coal used in its manufacture.

Multiplied attempts have been made to displace this most ancient of ovens, but these have so far accomplished very little. The 15,144 bee-hive coke ovens now in operation in the Connellsville coke region bear testimony to the appreciated value of this oven. The Connellsville coke is a standard coke so far as known on the continent of North America.

The physical and chemical properties of this bee-hive oven coke are fully shown in the table in the foot note below.

Its use in blast furnaces fully maintains the character given in the table. At a large furnace 1897 pounds of this coke produces one gross ton of Bessemer pig iron, and the output of the furnace is correspondingly large

(8,478 gross tons per month), exhibiting the energy and economy of this fuel.

In Virginia and West Virginia excellent coke is also being produced in the bee-hive oven, some of which approximates very closely to the Connellsville standard.

The Cumberland Valley Colliery Company, of Pineville, Ky., make a most excellent coke in their bee-hive ovens, one of which has been a surprise in the degree of its purity and physical properties, being somewhat superior to the standard Connellsville. Hence so far as the quality of the coke produced in this oven for metallurgical purposes, it is the peer of any other class of oven. It may seem strange that through its long years of faithful service very little improvements have been made in its general form or its details. Quite recently, however, the size of the oven has been enlarged so that the standard oven of the Connellsville region at present is 12 feet in diameter across its floor, and the height from the center of the floor to the top of the dome under charging port is 7 feet. This enlargement has been made with a primary view of increased output, and also reducing the percentage of waste at the door of the oven where air has to be admitted to mix with gases and support combustion in the dome above the charge of coal in the oven. The

door of this oven has been enlarged and its height increased so as to permit the air to be introduced at a level above the charge of coal in the oven, so as to have as little contact with the coal in introducing the air into the oven as possible, thereby lessening the ashes or waste that is made in this way.

The accompanying cuts (made from actual working drawings) illustrates the dimensions and manner of construction. In Fig. 1 is shown a transverse section of a bank of these ovens, the one at the left being shown completed, the right hand drawing illustrating the manner of construction. Fig. 2 shows the ovens in plan and Fig. 3 in elevation.

It will be noted also that in the general method of building these ovens a thinner variety of building stones are used. In fact, stones from three to four inches thick, make the best bond, and have greater endurance than the larger stones hitherto used in such structures.

The iron frame to the oven door has been modified by removing the arch piece, which was found in its expansion and contraction to shatter the masonry above the door. The frame, with its three sides, is sufficient to protect the jambs and posts of the doorway from the friction of the rabbling irons.

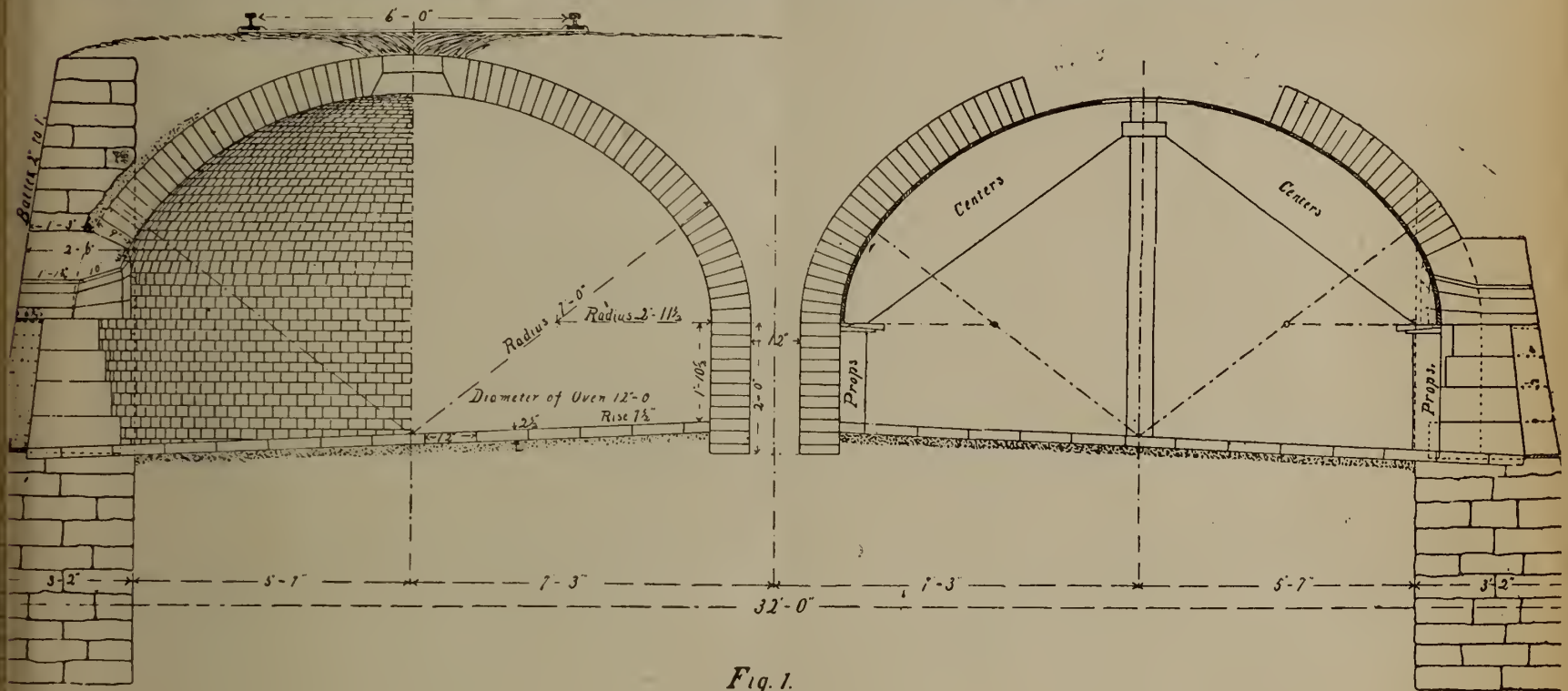


Fig. 1.

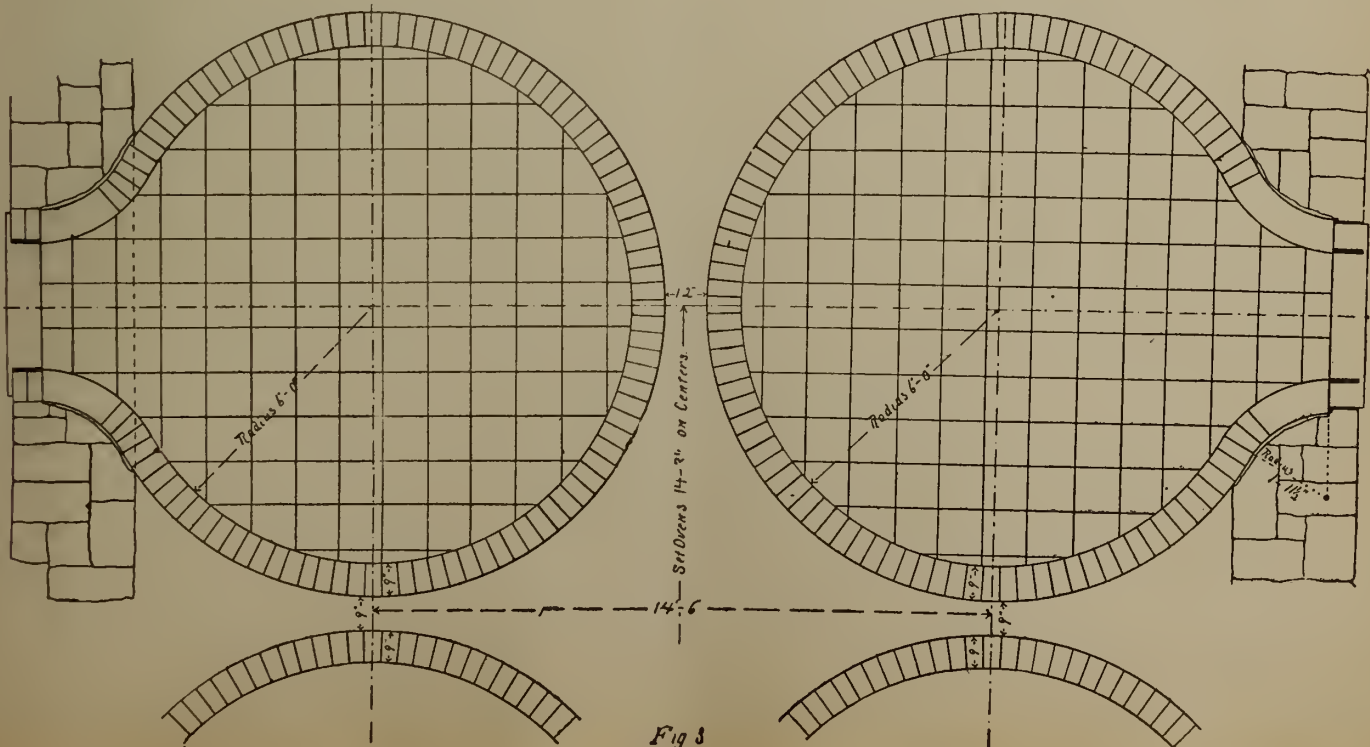


Fig. 3

The Desulphurization of Pyritiferous Iron-Ores.*

By Sterling G. Valentine, PH.D., Lebanon, Pa.,

(Continued from Page 108.)

Some pieces of Cornwall ore, similar to those used before, were heated beyond their sintering point, and as quickly as possible, to intensify the effect. For comparison the former results, obtained on heating at a low temperature, are added:

No. of Heat.	Temp. ° F.	Duration.	Per Cent. Total Sulphur in Residue.	Sulphur as Sulphide.	Sulphur as Sulphate.	Per Cent. Total Sulphur as Sulphate.
1	1200	2 hrs.	0.346	0.235	0.111	32.18
2	1200	4 hrs.	0.178	0.088	0.090	51.12
3	1500	1 hr.	0.099	0.027	0.072	72.72
4	2400	45 min.	2.125	.....	.....	.....
5	2400	45 min.	2.422	2.337	0.085	3.50

Recalling the fact that the raw ore contained 2.664 per cent. of sulphur, the effect of the sudden fusion can be readily noted in the differences between the results of the first three heats of the last two.

The following are analyses of some clinkers taken from roasters working on Cornwall ore, showing the same effect:

Per Cent. Total Sulphur.	Sulphur as Sulphide.	Sulphur as Sulphate.	Per Cent. Total Sulphur as Sulphate.
1.397	1.224	.173	12.380
1.380	1.245	.135	9.782
1.873	1.777	.096	5.125

These results indicate plainly that the fusion of ores in roasting may prove prejudicial to good results. When it once takes place it is scarcely possible for desulphurization to proceed further. The vicid coating of fused iron oxide, silica and lime, or whatever may, in various cases, go to make up the impervious exterior, is a barrier both to ingress of air and egress of sulphur in any form. If the heat in any roasting process must be carried to so high a point, it should be gradually raised, and sintering should take place only after continued heating at a lower temperature in abundant air. I have frequently found pure sulphur condensed in the cavities of cold clinkers, where it had been vaporized from pyrites, but was unable to escape. Clinkering ore quickly is equivalent to roasting without air, and even more, for the sulphur that heat alone would vaporize is imprisoned in the mass. Furthermore, it prevents any great amount of the sulphur left from being in the form of sulphate.

Ledebur states that desulphurization will be the more complete the smaller the pieces of ore, the more freely air has access, and the higher the temperature or roasting.* It is easy to understand that small pieces means greater surface exposure and less requirement for penetration for heat and air. We have seen that air is absolutely needed for everything like a complete desulphurization. As to temperature, our results do not bear out the asserted necessity of a high heat for thorough roasting in all cases.

The practical application of all these conditions in the roasting of ores is a matter of no little difficulty. A proper roaster must be one in which the heat is under control, the ingress of air ample, and the egress of the products of combustion prompt. A gas-roaster seems to approach most nearly to these conditions. The Giers kiln in any of its forms seems to be a very deficient apparatus for desulphurization, because it has none of these qualifications. Its effectiveness is about on a par with roasting without air, for little or no air can get at the ore while it is being heated in this style of kiln. Being fired with solid fuel, it is, as a rule, under little control as to temperature, and the greater number of them are chronically "clinkered."

The working of such a kiln can be seen from a few analyses at hand. At the Musconetcong Iron Works, in a modified form of this kiln, the results as given by Mr. J. P. Pardee (*Trans.* xv., 680), were as follows:—

	Per cent. Sulphur.
Raw ore.....	0.883
".....	0.68
Roasted ore.....	0.39
".....	0.29

Cornwall ore roasted in Giers kilns gives the following results:—

	I	II	III	IV
Per cent. sulphur.....	80	1.41	1.05	1.12

As this ore runs from 2½ to 3 per cent. of sulphur, the analyses show only imperfect desulphurization, and are comparable to roasting out of contact with air. As a rule, not more than half the sulphur is removed.

The following conclusions may be drawn from this investigation, in regard to pyrite ores:—

1. Heat alone, without access of air, can remove, at best, only one-half of the sulphur present.

2. Atmospheric oxygen is absolutely necessary for a proper desulphurization.

3. Even at a low heat, ore is properly desulphurized if air can gain access freely to the FeS₂ in it.

4. Sulphate of iron can be decomposed by heat equally well with or without air.

5. In order that the residuum of sulphur in roasted ores may consist, so far as possible, of sulphates, the roasting must be done under free access of air.

6. Fusion or sintering of ore is likely to prevent any further desulphurization.

7. Sintering does not allow much of the remaining sulphur to be in the form of sulphate.

8. Fusion, hence, should never occur in roasting except after continued heating in air at a lower temperature.

9. Ores cannot be properly desulphurized in the upper part of the blast-furnace.

10. An efficient roaster must allow easy control of heat, abundant air access to the hot ore, and rapid removal of the products of combustion.

*Handbuch der Eisenhüttenkunde, p. 188.

The Future of the Port Arthur Silver Region.

"I believe," says Mr. Herbert R. Wood, in a paper read before the Canadian Institute, "this region must ultimately take a foremost place among the silver mining districts of America." My reasons are these:—1st. The universal excellence of the ore, while much is extremely rich, running as high as ten or twelve thousand dollars a ton; it is all good average mill-work. 2nd. The close proximity of the ten locations in the second group, all within a radius of three or four miles, leads one to believe the belt has plenty of out-crops awaiting the prospectors' pick. 3rd. As the depth of mining increases the value of the ore does not necessarily decrease, as the richest ore is in zones or pockets, liable at any moment to come into view. 4th. It is as yet a new mining region and but awaits the thorough and satisfactory trial of one or two mines to ensure the development of all. 5th. From a geological point of view the veins should all be rich, satisfactory mines. They trend with hardly an exception north-west and south-east, and are true fissures in all probability formed by the one convulsion of nature and similarly filled. The difficulties that have hitherto attended the development of this mineral region seem to have been in several cases the Temerity of the capitalists unacquainted with mining and the expenditure involved in sinking into rich zones of ore. In other cases properties have become mortgaged, mismanaged, till finally abandoned. What is needed is thorough mining men to take hold with lots of capital and push the mines and sink till the mine becomes a settled organization, working, yielding and paying.

Notes on Some Coals in Western Canada.*

By Wm. Hamilton Merritt, F.G.S., Toronto.

With the exception of the Vancouver Island coal, all the western coal fields owe their present development to the completion, in the autumn of 1886, of the Canadian Pacific Railroad. While it could not be expected that a very great deal could have been accomplished in three years, enough has been done to pretty thoroughly establish the coal-bearing areas and their correspondence with those which have been developed to the south of the boundary, along the lines of the transatlantic railroads in the United States.

This summer I visited some of the important developments in the coal areas of Washington Territory, largely with the object of being better able to appreciate the corresponding coal-bearing areas in British Columbia to the north.

In Western Canada coal-bearing rocks have been found in three zones:

1. In the plains to the east of the Rocky Mountains, and in the eastern flanking ranges, the coal occurs in the Cretaceous formation (including the Laramie).

2. In the interior plateau of British Columbia the coal is found in the Tertiary formation.

3. On the coast of British Columbia Cretaceous and Tertiary rocks are found carrying coal, and on the Island of Vancouver the well known Nanaimo coal has been worked for years in the first-named formation.

In all of these zones the coals vary from lignites up to higher grades, the factor determining quality being the amount of pressure to which they have been subjected. The intensity of this pressure is generally shown by the

disturbance which the coals exhibit, and, in many cases, is almost directly in proportion to the distance of the deposits from mountain ranges. This seems to be also the opinion expressed by Mr. Bailey Willis in connection with his Census Report on the coals of Washington. It has been elsewhere stated that super-imposed strata has been thought to have been an important factor in these changes; but my observations for several years in all these areas lead me to the conclusion that it is pressure alone from distortion and upheaval that has altered these western coals into the many varying grades in which they are found to exist.

In the first zone an enormous amount of coal occurs in the territory between the western borders of Manitoba and the Rocky Mountains. I shall merely note some of the seams, which are reached by rail, as examples of the character of the coals in the area mentioned. In the plains they are all lignites, changing to a high-grade lignite at the Galt mines (which are reached from the Canadian Pacific Railroad by a branch railroad 110 miles long), into a bituminous coking coal at the Bow River mines (where a 7-foot seam cuts across the main line of the Canadian Pacific Railroad), and finally, the maximum result of the metamorphic influence is reached in the Cascade Valley, where the pressure of the mountains on both sides of the Cretaceous trough, has altered the coal which it contains into an anthracite.

The following analyses, passing from east to west, convey some idea of the types of these coals:—

TABLE A.—EASTERN ZONE.

	a.	b.	c.	d.	e.
Water.....	20.54	10.30	6.50	4.41	0.71
Volatile combustible matter.....	33.26	34.40	38.04	40.32	10.79
Fixed Carbon.....	41.15	39.61	47.97	48.27	80.93
Ash.....	5.05	15.64	7.55	7.00	7.57
Total.....	100.00	100.00	100.00	100.00	100.00
Coke.....	None.	None.	None.	Good.	None.
Approximate distance from mountains, miles.....	234	128	36	28	0

a.—Medicine Hat, lignite (Geological Survey) fair coking.

b.—Crowfoot " " " " " "

c.—Galt " " " " " "

d.—Bow River mines, bituminous, " " " "

e.—Cascade Valley, anthracite, " " " "

In the interior plateau of British Columbia lignite and coal have as yet been found in only a few places. The following are the only occurrences yet discovered worthy of notice:

At Princeton, or Allison's, some 20 feet of alternating lignite and shale seams occur, lying at a gentle dip. The lignite can be obtained of a workable thickness, but the greater part of the bed is too much mixed with shale. The character of the lignite, as indicated by the analysis, is that of an inferior coal.

The lignite found at Marble Canyon, Hat Creek, is of a better description, as shown by the analysis. It is said to be of very considerable thickness. I did not think the quality sufficiently good to justify a visit to the place, which has been described in the Reports of the Geological Survey.

At Kamloops, close to the Canadian Pacific Railroad, coal of a very fair bituminous character has been found; but as yet seams of only about a foot in thickness have been opened up. The vicinity is being tested by a shaft.

In the Nicola Valley, some 49 miles from the railroad, a seam of bituminous coal, about 5 feet in thickness, has been exposed. This coal has been subjected to a greater amount of metamorphic influence than any yet discovered in this zone. It lies adjacent to a mountain, which is probably a result of the disturbance that has altered it into a good coking bituminous coal.

TABLE B.—INTERIOR ZONE.

	a.	b.	c.	d.
Water.....	15.75	8.60	6.26	36.065
Volatile Combustible matter.....	35.40	35.51	39.97	
Fixed carbon.....	41.45	46.84	48.22	
Ash.....	7.40	9.05	5.55	
Total.....	100.00	100.00	100.00	100.000
Coke.....	None.	None.	Fair.	Very good.

a.—Allison's, lignite.

b.—Hat Creek, lignite (Geological Survey).

c.—Kamloops, bituminous.

d.—Nicola, bituminous, (Geological Survey).

On the Pacific Coast zone, on the main shore, there has as yet been located a very small amount of coal and lignite, in the districts which correspond to the large areas

developed along the Puget Sound to the south of the international boundary. And, as has been ascertained to the south of the line, the coal which has been found near the coast is merely a lignite, but that which occurs inland, near the Cascade Range, has been altered into a bituminous coal. A sample of the latter type is found in a 2-foot, somewhat dirty, bed of coal, which has been opened on the slope of Sumas Mountain. Still further inland, the Cretaceous conglomerates occur near Chillawack, but all the coal which they have so far been found to contain consists of a few small masses forming part of the conglomerate, and some very thin strings of a coaly matter. The analysis from the above-mentioned Sumas Mountain seam is as follows:—

Analysis of Sumas Mountain Coal.

	Per cent.
Water	4.62
Volatile combustible matter	35.68
Fixed carbon	42.00
Ash	17.70
Total	100.00
Coke	Fair.

*Transactions of the American Institute of Mining Engineers.

Haase's System of Sinking Through Quicksand.—The management of the Guenin colliery, Cottbus mining district, Germany, while sinking a pump shaft to a depth of 87 feet through quicksand, recently employed the Haase system, the chief feature of which consists in driving down a series of wrought iron tubes, side by side, so as to form a cribbing for the intended shaft. The tubes are 13.1 ft. long, with an internal diameter of 4.1 in. and 0.2 in. thick. Wooden guides with cast iron crossbars at the top and bottom are attached to the timbering of the shaft so as to secure that the tubes take the required direction in their downward course. Six sets of the tubes were used to reach the coal seam. The shaft was 10.8 ft. by 8.5 ft. within the ordinary timbering, and 9.5 by 7.2 ft. within the tubular lining, and required 64 tubes altogether.

Increase of Wealth in the United States.—The rapid increase of the wealth, business and prosperity of the United States, during the past ten years, is simply marvelous. According to the published figures the total wealth of the country is now \$71,459,000,000, equal to nearly \$1,000 per capita. This is an increase in ten years of \$18,000,000,000, or 42 per cent. Great Britain's wealth in 1885 is given at \$50,000,000,000. The average of wealth per head in England is \$1,545, in Scotland \$1,215, in Ireland but \$565. The total wealth of France is estimated at \$36,000,000,000. England exacts in taxes \$20 per head of population, while each individual in the United States pays \$12 50. America will produce 7,000,000,000 tons of iron this year, while England's greatest production is 8,600,000 tons.—*Engineer.*

SITUATION WANTED.

A Blast Furnace Manager, who has had many years' experience at Anthracite and Coke furnaces, desires a position as Manager. Can give the best of references.

Address,
BLAST FURNACE,
CARE THE CANADIAN MINING REVIEW,
OTTAWA, ONT.

SOCIÉTÉ

Canadienne d'étude Minières
CAPITAL, - - \$100,000

Assaying, Prospecting and Mining.

HEAD OFFICE, - - - 30 St. FRANÇOIS XAVIER ST
P. O. Box 1625, MONTREAL.
Office in Paris (France) 12 Place Vendôme.

DIRECTORATE:

M. SCHWOB, Vice-Consul of France, President
JOHN S. HALL, Q.C., M.P.P., Vice-President.
C. A. DUGAS, Judge of Sessions } Directors.
C. H. A. GRANT, }
C. DUQUET, Alderman, Quebec, }
G. WERNER, Secretary and Treasurer.
J. DE LA VALLEE POUSSIN, I.C.P. } Consulting Engineers.
JOHN D. FROSSARD, M.E. }
JOHN S. HALL, Q.C., M.P.P., Advocate, Legal Adviser of the E.L.

LEDoux & COMPANY,

10 CEDAR ST., NEW YORK.

Engineers, Metallurgists &
Assayers.

Public Ore Sampling & Storage Works

All the principal buyers of furnace materials in the world purchase and pay cash against our certificates of assay, through New York banks.

By special permission of the Secretary of the Treasury of the United States, cars of ore or copper matte passing through in bond can be opened and sampled at our works.

Consignments received and sold to highest bidder. Send for circular giving full particulars.

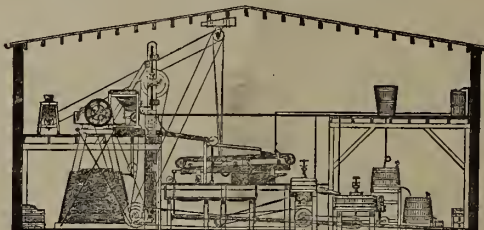
Mines examined and sampled. Assays and Analyses of all kinds.

Charles M. Rolker,

— LESSEE, —

New York Ore Milling & Testing
WORKS.

Office, - - 18 Broadway, New York.



Cable Address:—PHAFTRY, New York.

Consulting Mining Engineer.

Examinations made and reports rendered of mines and mining property, metallurgical works and processes. Ores can be practically tested by any known process and the necessary plan of reduction determined. Works are complete in every respect for practical testing of Gold, Silver and Concentrating Ores and Tailings. ANALYSIS of ores and furnace products, etc.

CANADA ATLANTIC RAILWAY.

THE SHORTEST PASSENGER ROUTE BETWEEN

Ottawa & Montreal

AND ALL POINTS EAST & SOUTH.

The only road in Canada running trains lighted with electricity and heated by steam from the engine. Luxurious Buffet Pullman Palace Cars on all trains between Ottawa and Montreal. Only line running through Sleeping Cars between

Ottawa, Boston and New York

And all New England and New York points.

Baggage checked to all points and passed by Customs in transit.

For Tickets, Time Tables and information apply to nearest agent or to
S. EBBS, City Passenger Agent,
GEO. H. PHILLIPS, Gen. Agent, 24 Sparks St., OTTAWA.
VALLEYFIELD.

A. E. CAIRNS, General Agent,
136 St. James St., MONTREAL

Or at 260 Washington St., Boston, and
317 Broadway, New York.

E. J. CHAMBERLAIN, General Manager,
C. J. SMITH, General Passenger Agent,
General Offices, Ottawa.

HARRIS & CAMPBELL

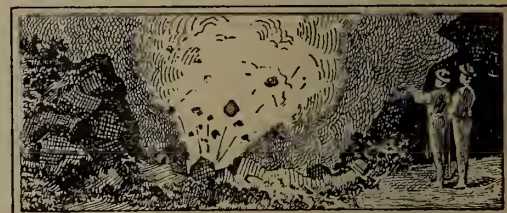
Latest Designs in Drawingroom, Diningroom
and Bedroom

FURNITURE

With improved Steam Machinery our facilities for manufacturing Cabinet Goods are complete. Our upholstery Department is well stocked with latest imported patterns.

Corner QUEEN & O'CONNOR Sts.
OTTAWA.

Standard Powder Company



MANUFACTURERS OF ALL KINDS OF
GLYCERINE

EXPLOSIVES

—FOR—
MINING

—AND—
RAILROAD WORK.

ADDRESS—
W. H. HARRISON,
MANAGER,
BROCKVILLE, ONT.



Intercolonial Railway OF CANADA.

The direct route between the West and all points on the Lower St. Lawrence and Baie des Chaleurs, Province of Quebec; also for New Brunswick, Nova Scotia, Prince Edward and Cape Breton Islands, Newfoundland and St. Pierre.

EXPRESS TRAINS leave Montreal and Halifax daily (Sunday excepted) and run through without change between these points in 30 hours.

The Through Express Train cars of the Intercolonial Railway are brilliantly lighted by electricity and heated by steam from the locomotive, thus greatly increasing the comfort and safety of travellers.

New and Elegant Buffet Sleeping and Day Cars run on all through Express Trains

CANADIAN EUROPEAN MAIL
AND PASSENGER ROUTE.

Passengers for Great Britain or the Continent by leaving Montreal on Friday morning will join Outward Mail Steamer at Halifax the same evening.

The attention of shippers is directed to the superior facilities offered by this route for the transport of flour and general merchandise intended for the Eastern Provinces and Newfoundland; also for shipments of grain and produce intended for the European market.

Tickets may be obtained and all information about the route, also Freight and Passenger rates, on application to

G. W. ROBINSON,
Eastern Freight and Passenger Agent,
136½ St. James St., MONTREAL.

E. KING,
Ticket Agent,
27 Sparks Street,
OTTAWA.

D. PORTINGER,
Chief Superintendent,

Railway Offices, Moncton, N.B.
14th November, 1889.

The Canadian Mining Review

CONDUCTED BY OFFICES: E. T. A. BELL

UNION CHAMBERS, 14 METCALFE ST.,
OTTAWA.

Vol. IX. SEPTEMBER, 1890. No. 9.

To Our Readers.

The present issue of the *Review* has been delayed in publication through an unforeseen mishap to our printing house.

The Iron and Steel Institute.

The members of the Iron and Steel Institute who are holding a Meeting conjointly with the American Institute, of Mining Engineers in New York, will pay a flying visit to the Sudbury mines and works during the month.

At the request of the Government we wired Dr. Raymond with the object of ascertaining if the Dominion could not be favored with a more extended visit, and in reply we were informed that the arrangements made precluded any definite answer until a later date. Dr. Selwyn will be in attendance at the Meeting, authorised by the Government to extend an invitation to the Institute to visit the Dominion. The visit by these eminent metallurgists and ironmasters would unquestionably result in much benefit to the country, and we trust that it is not yet too late to have them partake of Canadian hospitality.

Systems of Phosphate Mining.

In the earlier days of the Canadian Phosphate industry, mining was largely carried on by contract. The miners provided their own dwellings, tools and supplies, and the owner of the property incurred no outlay or expense, except to pay for phosphate won. This was usually paid for at the rate of six dollars a ton, the standard quality being seventy-five per cent. and any phosphate below that grade was liable to rejection. It was customary to pay monthly, at the rate of five dollars a ton, on a measurement of twenty cubic feet to the ton, one dollar's margin being reserved for a final settlement on the weight. An advantage of this system is that it avoids the investment of capital by the mine owner and saves him from all risk of loss in prospecting for shows or in working unproductive seams. It also secures an output that would not otherwise be made, as neighbouring farmers will occasionally put in a few week's work and produce ore at a rate that ordinary laborers would not accept as day wages. But the disadvantages of this method of working phosphate mines are many and have caused a general abandonment of the system, except for an occasional venture in a small way. The chief difficulty is to secure good quality. The miners build up walls with handsome blocks of apatite, within which they pile as much dirt as opportunity and conscience

will permit, and the latter deterrant is not often operative. As payment has to be made monthly and every analysis by a chemist costs five dollars, expense debars the owner from securing accurate tests, and, as in the winter time the piles freeze into a solid mass, the difficulty of inspection is great. Many a cargo of contract mined phosphate, upon which great hopes of profit were based, has gone below guarantee in Europe and been rejected by the purchaser. Another objection to this system of mining is the bad condition in which the property is left. The contractor, intent only upon present gain, works his pits in a cheap and shiftless fashion, having as much debris as possible unhoisted and working in the smallest space in which he can move. He "gouges out" the seam and moves to a new surface show to repeat the operation, the consequence being that the property is soon covered with holes in the ground that require an outlay before they are workable. There is a strong moral objection to this system. It places men in a position where all their interest lies on the side of dishonesty and where there is every facility for its commission. Contract work in sinking shafts and running drifts is popular and safe and is largely resorted to at the Sudbury Copper Mines at present. The men in such case are paid by the fathom of excavation and their work is readily checked. But the conditions of phosphate mining are very different, and both materially and morally the contract system of mining as applied to it must be pronounced bad.

The usual system of phosphate mining is by day labor. The chief difficulty about it is the lack of incentive to the workman to render faithful and efficient service. If he can get through the day without rebuke from the "boss" the less he does for his wages the better it suits him. In large mines under good superintendence and strict oversight and where machinery is used a fair amount of effort is secured from the men; but when the work is scattered over a wide area or is under careless management the loss from neglect on the part of the laborers is very great. Many a small enterprise that properly managed might have grown to success has been ruined by loafers. The city owner makes a rare visit to the property and sees things going on briskly. On other days the manager takes his horse and buggy and drives to the neighbouring town for a bar of soap or a hammer and the men "take it easy." Over-estimated reports of output are given and it is not long since a company, that was supposed to have 500 tons of ore raised, discovered a weight of only 150 tons.

A remedy for the ills of these two systems of mining seems to exist in the form of co-operation or profit sharing. Experience shows that it is impossible to devise means to avoid loss by dishonesty and laziness under the contract or wages system. Some miners are dishonest and lazy and all have a good deal of "human

nature" in them and it is natural for men to give as little work for the money as policy will permit. The only effective way to overcome this tendency is by stimulating self-interest. If the miner's pay was contingent on the quantity and quality of the ore raised, an inducement would exist for him to use his best exertions. With a shifting force such as is commonly employed in mines this method is not easily practicable, but where steady labor is employed and the men are residents of the region some system embodying this principle of co-operation seems to be feasible and it is to be hoped that it may be tried in the phosphate industry. It was attempted in one case a few years since, but as the mineral was scarce no amount of effort could secure a profit. In nearly every department of industry, associative work for common profit appears to be proving its fitness by favorable results; but the difficulty of its application to mining has so far afforded but little opportunity for the introduction of this humanizing system. If it could be tried under suitable conditions and the success of the enterprise was alike the concern and interest of employer and employee or a mutual association of workers probably the results would be satisfactory to the pocket as well as elevating to the moral nature.

The Springhill and Wellington Strikes.

Reference has already been made in these columns to the strikes at Springhill and Wellington, the two extremes of the Dominion. So important, however, are the relations between labor and capital, and so widespread are the effects of any disturbance or quarrel leading to suspension of work that the subject may bear another reference. It is claimed and with a fair show of reason that Canadians are quite as well educated as their cousins south of the line, and rather more so than Europeans. This rule applies to our miners as well as to any other class, they being intelligent, quite capable of understanding their business, and usually newspaper readers.

Strikes among miners appear in many cases to arise from an accumulation of feeling that they are unjustly treated in some respect, a belief which is nurtured by their forming isolated communities, and by the ascendancy which is readily acquired by any of their number possessing the art persuasive, and by the gift of organisation. In many cases it has been found that masters have failed to meet their employees in a friendly spirit, and that changes however necessary have been carried out in an arbitrary manner. As the two elements of capital and labor are completely dependent on each other, common sense would dictate to both sides, a policy of forbearance, conciliation, and fair play. There are of course certain conditions which do not always admit of compromise or argument. A demand is made for an increase of pay or a lessened wage rate. If these cannot be conceded in any instance under consid-

eration, there is in the fair way of looking at business matters, nothing left but for the two parties to separate.

The general public suggest arbitration as an universal panacea. In Nova Scotia an arbitration Act was passed some years ago, and action taken under it by the Springhill miners; owing to technical defaults made by them the case never came to arbitration, enough however was done to suggest a new Act which was passed. As yet no case has been submitted to arbitration under it, and it can be understood that the Springhill miners smarting under their defeat when trying the first Act, hesitated to commit themselves to the later legislation. The Springhill strike was not directly one for higher pay, but for a readjustment of dockage for excessive amounts of stone in the coal sent out by the miners, as already mentioned in these columns, and some similar matters. The complaint against a long established system of dockage had gone on for some time, until a strike was resolved on as the best means of settling the question.

It is to be regretted that the matter was not submitted to arbitration, as it was a proper one for that method of treatment, and no doubt an award would have been given fairly meeting the requirements of the case. The matter being in fact the necessity of the Company having clean coal to furnish to its customers. This being common to the welfare of both the company and the miners, an admission to this effect on the part of the latter, and a promise to send up clean coal, would doubtless have paved the way to a ready compromise as to fines, dockages etc. Arbitration is perhaps better suited to meet disputes such as this, than to deal with abstract principles of wages. If a body of men believe that they should have an advance of pay conceded to them, no arbitration can convince them that they are wrong in their opinion. Where differences arise in details of work, employees more readily accept a solution differing from the one they had designed, for all are aware of the wide differences in mining conditions and practice in various localities, but no one has yet succeeded in convincing a man that, his wages are a full equivalent for his days labor.

In the case of the Wellington strike the demand for an eight hour shift to count from the time of leaving the surface to returning to it is really one of wages, and the Company alone can say if they are in a position to grant it. If the profits of the operations permit of its being granted, there is a fair ground for a bargain, so that in return for the concession of a shortened period of labor the Company may have the support of the men in more regular work, and the discharge of men who are too fond of lay days. As to the second demand, the recognition of the men as a Union, there is a wide spread desire on the part of all employers to deal with their hands as individuals, and naturally so, for a lazy or stupid employee is often a

direct source of loss. It has been noted that men of this class are not unfrequently allowed by their fellow workmen too much sympathy against their employers, which in the long run operates against the interests of the employed. There are, however, many colliery managers who not only recognize their employees "Union," but find it a help in prosecuting their business, and there can be no doubt that a mine manager, if he deals with the representatives of his men in a fair and friendly spirit, often enlists in them, their trusted representatives, efficient assistance in curbing the discontent of these men who always have a real or fancied grievance.

It is not quite clear what is meant by the third demand that a committee of the employed, or Union should investigate in all cases of dispute between masters and men. A committee could not be expected to act impartially when they are delegates of the parties interested. In any scheme of voluntary arbitration it is always open for either side to say whether the matter is not one for arbitration, and it has seldom been found that a steady adherence has been given to this method of solving disputes. The idea of compulsory arbitration has often been mooted, but the practical difficulty of compelling a body of workmen to abide by its decisions is at once apparent. No Government in the Dominion is ready to undertake the task of putting a thousand or so of workmen into jail, and as the Companies have available assets that can be attacked by fines, etc., such a method appears unfair whenever a Company demurred at obeying an unfavourable decision. It must be admitted that if a Company offers arbitration or is ready to act up to a compulsory arbitration, some assurance is due that the defaulting side should be coerced into accepting the results of a fair judgement.

The most feasible road toward the solution of these difficulties in reconciling the unceasing disputes between capital and labor appears to be the cultivation of a spirit of friendliness, and the untiring efforts of all concerned in or associated with industrial communities directed toward educating both parties into a sense of the unreasonableness and folly of cessation of work, and to inculcate in them the knowledge that outsiders, practically qualified, are almost invariably the best judges of what is fair between man and man. Business men continually find that their differences are most readily settled by arbitration, and in many cases law suits are resorted to as a form of arbitration rather than as a means of indulging in obstinacy or personal feeling.

Employees should endeavor to identify themselves as far as they can with the interests of the corporation they are engaged with as every good day's work done in an ungrudging spirit benefits the employer who is enabled to produce a better article, and to give his hands steadier work. On the other side it is unquestionable that a frank recognition of the daily toil of the workmen in any concern, and a

desire for their advancement, coupled with some share in any profits over and above a fair return on the capital invested would lead to a better understanding and remove the idea too often prevailing among the employed that they are only tools to be flung aside when their usefulness is passed.

American Institute of Mining Engineers.

According to circular from Dr. Raymond, the fifty-seventh meeting of the American Institute of Mining Engineers will begin in New York on Monday afternoon, September 29th, at 2 o'clock. All sessions will be held at Chickering Hall, 130 Fifth avenue; hotel headquarters will be at the Park Avenue Hotel. The sessions of the Institute for the reading and discussion of papers will be Monday afternoon and evening, and on Thursday morning, afternoon and evening.

On Wednesday, Thursday and Friday mornings the sessions of the British Iron and Steel Institute will take place.

On Wednesday afternoon there will be an excursion of the two societies, and invited guests, up the Hudson River.

On Thursday afternoon, the Holley Memorial will be unveiled in Washington Square. The commemorative address will be delivered in Chickering Hall, previous to the open-air ceremony, by Mr. James Dredge, editor of *London Engineering*.

Other than members at the discretion of the general committee, may accompany the excursionists and partake of the entertainment *en route*, at the following rates, which cover railway fares and Pullman berths only:

New York to Pittsburg and return, \$20.

New York to Pittsburg and Chicago and return, \$30.

New York to Pittsburg, Chicago, and over the Northern or the Southern excursion route and return to New York, \$60.

Philadelphia or Pittsburg over either route and return to starting point, \$60.

Applications for joining the excursionists, accompanied with check for the amount of fare, should be made to Charles Kirchoff, 66 Duane street, New York city.

The Cariboo Mining District

We publish in this number of the REVIEW an engraving and sketch of Mr. John Bowron, the gold commissioner of Cariboo District, kindly furnished us by a subscriber—a resident of Cariboo and an intimate acquaintance of Mr. Bowron's. The Cariboo District ever since the discovery of gold within its limits in 1860, has maintained its superiority as the chief gold producing district of the Pacific province. The richness of some of her placer mines has been really phenomenal. The Diller Company on Williams' Creek (3 men) produced in April, 1863, within 12 hours, 104 lbs. weight of the precious metal, which is perhaps the highest

earning for the time occupied on record. But there were numerous instances of men jumping, within 24 hours, from poverty to affluence. Hitherto operations have been principally confined to placer or alluvial mining, from which source, it is estimated, some fifty to sixty millions of dollars have been produced. But the still greater wealth of this district in its quartz ledges is only now becoming apparent. The success which attended the working of a quantity of rock last season at the test works erected near Barkerville by the Provincial Government, puts the question of the value of the numerous quartz veins which intersect the country beyond a peradventure. Such, at all events, seems to be the opinion of the Government and Legislature, since, although the works were completely destroyed by fire last winter, they are already being rebuilt, and that upon a larger scale. English capital, too, is now seeking investment in the district, the result of an examination of the mines by an expert sent out from London last season. It is now also a matter of certainty that the district will soon have the advantages or railway communication, as two companies have been chartered and liberally subsidized by the Provincial Government, making the Cariboo mining region their objective point, or passing through it. This is at present the great want of the district, as, handicapped by fully two hundred miles of waggon road, over which all machinery and material for quartz mining must be hauled by freight teams, the advantages of carrying on extensive operations are serious. With the commencement of railway construction therefore we shall no doubt see the era of Cariboo's early prosperity renewed and perpetuated.

The Phosphate Corporation.

Throughout the Phosphate districts owners of Lots are cleaning out pits and fixing up shows in order to exhibit their wares to the experts of the General Phosphate Corporation who are now on a tour of examination with the purpose of buying up "all the Phosphate land in Canada." There will probably be a good deal of disappointment on the part of many who have been waiting for several months upon the promise of sale, for it is hardly to be supposed that any Company would buy more land than it can properly develop and work. It is to be regretted that some wealthy owners of lands who are abundantly able to work their properties do nothing but "fix them up" for sale at extravagant prices.

Statements, more or less incorrect, have recently been prominent in several of our local papers respecting the value of the stock taken up by the public in the Corporation. In some cases it is broadly stated to have collapsed; in others to have been partially successful. As a matter of fact the Company was *underwritten* before being offered to the public to an extent which assured it a fair start; and while only a comparatively small amount of stock was taken up by the public we have the assurance of the

chairman, Lord Stalbridge, that 20,000 shares have been allotted, equal to a capital of £20,000. As matters now stand the Corporation is on a distinctly better working basis and if judiciously operated should prove a success. A notice of the first meeting of the Corporation is given in another column.

The Phosphate Season.

Notwithstanding high prices and the accession this year of seven or eight new companies to the ranks of our Phosphate producers, it is apparent that the exports for this season will compare very unfavorably with those made in 1889 and in former years. A careful estimate points to 18,000 tons as a probable limit to the quantity that will go forward to Europe, while shipments to American and Canadian points, will in all likelihood not show any advance—if they equal last year's returns. Altogether we estimate that the aggregate shipments will not exceed 20,000 tons. This regrettable state of affairs must not, however, be in any way accounted to scarcity of ore, but rather to the temporary suspension of production on the part of the Emerald and North Star mines. The North Star will be remembered to have contributed by far the largest proportion of the entire output of last season, but pending certain negotiations for its transfer to new hands, but little work has been done this season. The new Companies did not start in until this season was well advanced and therefore could not be expected to compensate for the falling off in the other two. With a continuation of good prices, improved working plants, and the acquisition of the outputs from the new producers we think there is very good prospect of ample amends being made in the coming year for the unavoidable shortage in the yield for the present season.

A New Phosphate District.

Considerable interest has been excited by the report of phosphate discoveries in the district of country fifty miles northwest of Peterborough, Ontario. Mr. William Watt of Perth, one of the most experienced phosphate miners in Canada, has lately visited the region and spent a fortnight in making a thorough examination of it. He visited over one hundred phosphate lots and found the mineral on all of them. He states that it occurs in the form of crystals in a mixture of lime with small crystals of mica and he did not see a seam, vein or bunch of phosphate rock in any locality. A company has been working one property all summer and have secured a few tons of crystals. The country is described as consisting of long and high mountains covered with hardwood, offering a supply of fuel that seems inexhaustible. There is a great deal of pyroxene such as accompanies phosphate in the mines of Quebec and Eastern Ontario, and the region is what a miner would pronounce "likely ground," although as yet no discoveries of economic value have been made.

Sublime Gatherings of the Pundits.

If, as Carlyle used to maintain "the most reverend phenomenon" in the universe is man, then what could exceed in sublimity a gathering of the very flower of men, the two thousand odd pundits who compose the British Association for the Advancement of Science. Surely the most irrepressible cynic will be awed into reverend silence when he reads in *Nature* Professor Tilden's account of the organization and productive performances of some of the sections of this great institution.

"As a sectional secretary I have read papers (other people's) at three o'clock in the afternoon to an audience consisting of a vice-president impatient to follow the president to lunch, two reporters who were not listening, and my wife making signals of distress from a back bench. As a sectional president I have sat at the same hour, luncheonless and weary, while a paper which seemed as long as discursive as the story of the Ancient Mariner, was droned forth by the author to an audience of about three persons fidgeting like the belated wedding guest. I wonder whether this sort of thing is supposed to be of any use to anybody. I think, further, that something should be done to reduce the cost of a meeting to the town visited by the Association. The gorgeousness of the entertainments given, and the demands made upon provincial pockets, have become so extravagant that none but wealthy or ambitious towns can face the luxury of a visit of the British Association."

It would seem to be true that nothing is perfect in the world, not even the British Association.

LETTERS TO THE EDITOR.

The Tariff Question.

Truro, N.S., Sept. 19th, 1890.

The Editor:

SIR,—I am glad to see that you are championing the cause of the gold miner. If any industry in our Dominion required assistance in order to develop our great resources gold mining is the one. I thought the Act passed last session would assist to some extent this hazardous business, but such an interpretation has been put on the Act that it is practically a dead letter. Now, Mr. Editor, I do not believe for one moment it was ever intended to be the delusion it has so far proved to be. Why should copper plates, either plain or silvered, not be admitted free for gold mining? Why should the Gates ore-crusher not be admitted? The Gates ore-crusher is wanted by our gold miners, but the duty shuts them out. As you are on the ground I hope you will keep at the Government until they either interpret the Act to be of service, or abolish it. We are either entitled to have gold mining machinery, which is not manufactured in the Dominion, admitted free, or we are not; therefore I say let us have the answer, free or dutiable, then we will make no mistake in our calculations in that line.

My principal business is that of manufacturing gold mining machinery and I personally would have preferred leaving the duty as it was, but the Government having decided to change it, let us have some benefit from it as gold miners. I am largely interested in the business, and at the present time need for one mine in which I have invested, a Gates ore crusher. Hoping you will succeed in showing the matter in its true light and continue to assist in furthering the development of our rich mineral areas,

Yours, etc.,

GOLD MINER.

[We have submitted the whole matter to the Hon. C. H. Tupper and Sir John Thompson, who have promised to lay it before the Government. Both these gentlemen take a lively interest in the welfare of the miners of their province, and we may therefore rely upon their best endeavors to have this matter adjusted.—EDIT.]

Our Portrait Gallery.

[A series of portraits and biographical sketches of Canadian mining engineers, mine managers, inspectors, geologists, explorers, etc.]

No. 5

Mr. John Bowron, Gold Commissioner for the Cariboo District, B.C.

Mr. John Bowron, Gold Commissioner for the famous Cariboo District, British Columbia, is the youngest son of a gentleman prominent in the history of Lower Canada during the first half of the century, and a brother-in-law of Lieut.-Col. McEachren, C.M.G., of Ormstown, Quebec. His father, Wm. Bowron, Esq., a Yorkshireman by birth, emigrated when quite young to New York State, where he engaged extensively in lumbering and mercantile business; but on the breaking out of the war of 1812 removed to Quebec Province and became an active participant in the stirring events of the time. In the year 1818 he married Sarah Odell, only daughter of Col. Odell, of Odellstown, Quebec, and was for a time engaged in wholesale business in Montreal, but subsequently accepted a lucrative appointment from the then Governor General as Crown Lands Agent for that part of the Province now comprising the Counties of Huntingdon and Chateaugay. Having removed from Montreal he founded and settled in the Town of Huntingdon, which for a long time was known as Bowronville. Here, at the pretty homestead of Island Villa, on the banks of the Chateaugay, the subject of our sketch was born on 10th March, 1837, and here in 1852, full of years and honours, the old "Squire" died of apoplexy, which had first attacked him some two years previously at the very time he was about to lay the corner stone of the well known Huntingdon Academy, many of whose graduates are now prominent in the public life of the Dominion. It was at this academy that the subject of our sketch received the best part of his early training. Having removed to the Western States he there took up the study of law, but upon the discovery of gold in the Cariboo District he, with his nephew W. R. Schuyler, of Huntingdon, joined the first large overland party bound for the then far-off gold fields. This party, which numbered 136 men and one woman (a Mrs. Schuber, now of Ashcroft, B.C.), assembled at Fort Garry, now Winnipeg, on the 3rd June, 1862, and with an outfit of 96 ox carts, travelled slowly and wearily over the "Great Lone Land" to Edmonton. Here, of course, they had to abandon their carts, and packing their animals they crossed the Rocky Mountains to Tête Jaune Cache, on the Fraser River. At this point the party separated, some going south to the head waters of the Thompson, while the others continued down the Fraser in canoes or rafts. The small party known by the expedition as the Hunting-

don party, with which the subject of our sketch was more immediately connected, built a large raft in which, with nine of their animals, they made an eventful trip down the Fraser to Quesnell mouth, which they reached on the 11th September. Were it not foreign to our present purpose it would be interesting to relate the adventures of this first overland party, which comprised a number of the now prominent residents of the Province, as for instance, Mr. Mara, M.P., Mr. Tunstall, Gold Commissioner for Kootenay, Mr. Fortune, of Enderby, Mr. McMicking, and others.

Mr. Bowron being advised against going up to Williams' Creek so late in the fall, continued his journey to Victoria, where he spent the

hospital Board. Mr. Bowron has in the early days done his share of practical work in the mines, and has always taken a deep interest in the development of the mineral wealth of the district, in prospecting, which he has spent his resources freely. His confidence in a prosperous future for the mines has been constant and unbounded, which confidence recent developments in quartz seem amply to justify. On the bench as Gold Commissioner, Mr. Bowron finds his early training in law and his practical experience as a miner of decided value, and this qualification, with his well known impartiality, renders his decisions in mining disputes generally acceptable to litigants. Mr. Bowron was married in 1869 to Miss Edwards, of Michigan, and has two sons and two daughters.



Mining in the Cariboo District, B.C.

Dr. G. M. Dawson, Asst.-Dir. Geological Survey of Canada.

The Cariboo district, entered by the miners in 1860, has ever since produced the greater part of the gold of the Province of British Columbia. It has proved to be one of the best placer-mining camps ever discovered, and though most of the heavy runs of gold on bed-rock, so far found, may now be considered as worked out, its capability as a field for placer-mining of one kind or other is by no means exhausted, and the very limited area within which some of the richest finds have occurred encourages the belief that no great difficulty will eventually be found in tracing these alluvial deposits to their sources.

The fifty-third parallel of north latitude passes through the centre of the Cariboo mining district, which may be described as a mountainous region, but is, perhaps, rather to be regarded as the remnant of a great high-level plateau, with an average elevation of from 5,000 to 5,500 feet, dissected by innumerable streams which flow from it in every direction, but all eventually reach branches of the Fraser River. These streams, falling rapidly about their sources over rocky beds, descend into great V-shaped valleys, and, with the lessening slope, the rock becomes concealed by gravel deposits, which increase in thickness and extent till the valleys become U-shaped or flat-bottomed, and little swampy glades are formed, through which the stream flows tortuously and with gentle current. The steep-sloping banks of the valleys are densely covered with coniferous forest, of which comparatively little has been destroyed by fire, owing to the dampness of the climate at this great altitude. The surface of the broken plateau above is often diversified by open tracts, affording good pasture in summer; and the whole country is more or less thickly covered by drift or detrital matter, concealing the greater part of the surface of the rocky substratum. As in all new gold-mining districts, the shallower placer deposits, and gravels in the present stream-courses first attracted attention, but with the experience of California and Australia it was not long before the "deep diggings" were found to be far the most profitable. Williams and Lightning creeks have, so far, yielded the greater part of the gold of Cariboo. They were known from the first to be rich, but have been found specially suited for deep work, in having a hard deposit of boulder-clay beneath the beds of the present water-course, which prevents the access of much of the superficial water to the workings below. By regular mining operations the rocky bottom of the valley is followed beneath 50 to 150 feet of overlying clays and gravels, the course of the ancient stream being traceable by the polished rocks of its bed, and the coarse gravel and boulders which have filled its channel. In the hollow of the rocky channel the richest "lead" of gold is usually found, but in following the rock-surface laterally, side-ground, rich enough to pay well, is generally discovered for a greater or less width. The old stream-courses of the Cariboo district are found to have pursued very much the same directions that their present representatives follow, crossing often from side to side of the valley with different flexures, and occasionally running through below a point of drift material projecting

winter, returning to Cariboo in the early spring of 1863, where he has ever since resided, and been prominently identified with the progress and development of the mines, as well as every other enterprise calculated to promote the material or social well-being of the community. Mr. Bowron was appointed Postmaster in 1866, holding the position for 10 years; he became Mining Recorder in 1872; Government Agent in 1875 and Gold Commissioner in 1883, all of which offices he has filled with acceptance to the Government which he represents, and to the general satisfaction of the community in which he resides. He was one of the founders of the Cariboo Library in 1864, as also of the local Amateur Dramatic Club, and he represents the Government as Chairman of the Royal Cariboo Hos-

into the modern channel, but never, I believe, actually leaving the old valley or running across the modern drainage system, as is so often the case in the deep places of California and Australia.

The most important deep work was carried out in the old pre-glacial and buried channels of Williams and Lightning creeks, where it has now practically almost ceased. As the methods employed are, however, of interest in illustration of the mode of occurrence of the richer gold deposits, and may yet be applied to other valleys even in this district, the following description is included. It will serve as a general description of this class of mining, and is substantially the same with that given in the previous publication on the mines of British Columbia, and refers particularly to the work in progress at the time of my visit to Cariboo in 1876.

To reach the buried channel, on which it is generally impossible to sink directly through the superposed loose and watery materials, a shaft is usually sunk at the lower or down-stream end of the claim, on the sloping side of the valley, where, after having gone through a moderate depth of clay or gravel, the slaty rock of the district is reached. The shaft is then continued through this till a depth supposed to be sufficient is attained, when a drift is started at right angles to the course of the valley, and if the right depth has been chosen—either by rough estimation, or calculation based on that required in other neighbouring workings—the old channel is struck in such a way as to enable the subterranean water collecting in it from the whole upper part of the claim, to be pumped to the surface by the shaft. On driving out of the slate rock, however, into the gravel, so much water is frequently met with that the pumps are mastered, rendering necessary a cessation of work till the latter part of the season, or the application of more powerful machinery. When the drift is not found to be at a sufficient depth to cut the bottom of the old channel it is generally necessary to close it, and, after continuing the shaft to a greater depth, to drive out again.

The old channel once reached, and cleared of water, is followed up its slope by the workings, to the upper part of the claim, and where paying side-ground occurs this is also opened.

The richest pay is generally obtained in the actual channel of the old stream, but where this is much contracted the force of the water is often found to have swept the gold away to those places where its width is greater. The harder rocks still preserve their polished and water-worn forms, but most of the slates are rotten and crumbling to a considerable depth, and in cleaning up in the bottom, a thickness of one to two feet is frequently taken out with the pick and shovel, and sent up to the surface with the overlying gravel, for treatment. In the side-work, as in the central channel, the greater part of the gold is found lying directly on the bed-rock, though, in some cases, particularly on Williams Creek, paying layers occur in the gravel several feet above it. The side-ground is worked up from the channel in successive breasts parallel to it. The lowest layers of gravel generally contain many large boulders of quartz and slaty fragments not much water-worn, which must have come down from the hill-sides; the appearance being that of deposit by torrential waters to a depth of four to six feet in the channel, above which the gravel is generally better rounded, and more evenly spread, though still mixed with clayey matter.

In consequence of the unconsolidated nature of the gravel, the pressure on the supports of the workings is often excessive. The sets of timber are, in some places, only a few inches apart, and the whole of the workings have, in some cases, to be lined with complete lagging. The timber used is usually massive, being from one to two feet in average thickness, and consisting of the spruce of the country, simply barked and sawn into lengths. Its cost delivered at the mine at the date mentioned was eight cents per running foot, all suitable sizes being taken at the same rate. The lagging, which is merely split out, four feet long, five inches wide, and two thick, cost \$7.00 a 100 pieces. With every precaution, the timbers are frequently crushed by the pressure, or the uprights even forced downward into the slate. Where large boulders are removed from the sides, or 'slum' is found, spruce brush requires to be extensively used behind the lagging, and in many places the water streams from the roof like a heavy shower of rain. The whole of such deep workings were, as a rule, annually filled with water at the time of the spring floods, and it was sometimes not till late in the summer or autumn that the pumps again acquired the mastery.

The following are particulars referring to the Van Winkle mine on Lightning Creek, which was the most successful in operation at the time of my visit in 1876:—

The claim covered about 2,050 feet in length of the valley, the deepest part of the old channel of which had been cleared out to a length of between 1,600 to 1,700 feet in October of 1876. Much side-ground, however, yet remained, and the workings sometimes attained a width of from 200 to 300 feet in following this up as far as it could be made to pay. The claim yielded the first dividend in December, 1873, \$40,000 having been

expended before gold was reached in the channel. It afterwards paid handsomely, having produced in one week gold worth \$15,700, and on other occasions at the weekly 'clean-up,' sums of \$14,000, \$12,000, etc. At the date above mentioned the total product of gold had amounted to the large sum of \$500,965.

In the Van Winkle mine the average depth of the workings was about seventy feet only, the lowest shaft being placed 300 feet from the stream, on the opposite side of which the rock rises to the surface, forming steep cliffs. The water was raised to within forty feet of the surface, when it was discharged into an adit 3,000 feet long, which was also used by other claims. There were two pumps, ten inches in diameter, the power being supplied by an eighteen-foot breast-wheel. This did not, however, represent the total volume of water pumped, as the ground of this claim was partly drained by others lower in the series, in which work could not be carried on till late in the season. In October of 1876 the following companies on Lightning Creek were driving their pumps day and night, the Van Winkle being the only mine clear of water:—

Costello Claim.—Pump, twelve inches diameter, nine-foot stroke, making ten strokes a minute.

Vulcan Claim.—Pump, twelve inches diameter, six-foot stroke, making eighteen strokes a minute.

Vancouver Claim.—Pump, twelve inches diameter, nine-foot stroke, making ten strokes a minute (double acting).

Van Winkle Claim.—Pumps, ten inches diameter, fourteen-foot stroke, making ten strokes a minute (two pumps).

The quantity of water being raised at this time would, therefore, amount to about 13,870 gallons a minute, or 19,874,000 per diem.

In many cases the machinery and appointments used in mining on the deep channel were very creditable, and almost the whole of this work was paid for by the miners of the district itself. Money gained in one enterprise was usually invested in another, and the shareholders in a mine were frequently to be found themselves at work in it. On Lightning Creek the old deep channel has been followed and worked out to a length of about 16,000 feet in all, and in addition a number of rich bench claims and tributary creeks have yielded good returns. In endeavoring to "bottom" the old channel further down the valley very great difficulty is encountered in consequence of the quantity of water and the increased depth of the sinking required. The Eleven of England is the lowest claim in which the old channel has been reached, and though evidence was here found in the finer character of the gold, of increasing distance from the main sources of supply it is probable that still lower portions of the valley may be proved to pay with improved facilities.

It is impossible to present complete returns of the amount of gold obtained from the old bed of Lightning Creek, but the following approximate statement to November 1st, 1875, published in the report of the Minister of Mines of British Columbia for 1875, is still of interest in showing how large this amount, in the aggregate, must have been. The claims are here arranged in their order following down the creek:—

Campbell and Whitehall.....	\$ 200,000
Dutch and Siegel (now Perseverance)	130,000
Dunbar.....	30,000
Lightning.....	153,962
Discovery and Butcher.....	120,000
South Wells.....	141,531
Spruce.....	99,908
Point.....	136,625
Van Winkle.....	363,983
Victoria.....	451,642
Vancouver.....	274,190
Vulcan.....	56,955
Costello.....	20,476

It would probably not be an exaggeration to state that the deep channel, for the portion of its length above referred to, with the adjacent side ground worked at the same time, has yielded throughout gold to the value of over \$200 to the running foot.

On Williams Creek, on which the towns of Baskerville and Richfield are situated, the chief workings have been in a space of about two miles and three-quarters in length. In this the deep channel has been worked through, and also as much of the side-ground as would pay at the time at which the mining took place. Many of the lateral creeks and gullies here have paid remarkably well; and the hill-sides, in some places to a height of a hundred feet or more, have proved to be sufficiently rich for the hydraulic method of working, which is now profitably carried on.

Though Williams Creek has produced in the aggregate the greatest amount of gold, Lightning Creek showed for a time a larger annual yield.

The Canon between Barkerville and Richfield divides Williams Creek into two parts. For about half a mile above it the ground was shallow, and has been worked open to the bed rock. Further up deep drifting was

practised in former years, and hydraulic work is now carried on. Below "The Canon" all the work has been deep; in the old channel, although "pay-streaks" were sometimes found after getting down about twenty feet, these were usually disregarded in early days. In the Cameron claim, however, half a mile below Barkerville, the dirt paid nearly to the surface, and was worked in stages from below after the old channel had been cleared out. The workings were about sixty feet deep at Barkerville, only thirty-five feet at the former site of Cameron, and at the Ballarat claim—three-fourths of a mile below Barkerville—eighty feet. This is one of the lowest claims in which the old channel has been bottomed, and most of the gold obtained was light and scaly. The valley is here wide, the present stream turning abruptly to the west, while a wide, low hollow, known as Pleasant Valley, runs off in the opposite direction to Antler Creek. It is supposed by many that the main channel of the ancient water-course turns off in this direction, but, owing to the great quantity of water and loose character of the ground, neither this nor the present valley of Williams Creek below the Ballarat has yet been proved, though much money has been expended in the attempt. The Lane & Kurtz Company went to great expense in importing machinery, and erected very complete works some years ago, but did not succeed in proving their ground, and have since abandoned the attempt. The place at which this work was carried on is known as "The Meadows," the valley here opening out and becoming wide and flat-bottomed. The company held a Concession covering about four miles in length of the valley, but succeeded in reaching a depth of 125 feet only, and in drifting out found that they were still too high for the deep channel, while the volume of water was greater than their pumps could master.

As showing the great local accumulation of gold in the deep channel of Williams Creek, and indicating its local origin, the following approximate statement of the value of gold obtained in various claims, covering certain lengths of the channel, is important. All these claims were below the Canon, but they do not form a consecutive series, no such details being available for many other claims:—

Adams.....	100 feet	\$ 50,000
Steele.....	80 "	120,000
Diller.....	50 "	240,000
Cunningham.....	500 "	270,000
Burns.....	80 "	140,000
Canadian.....	120 "	180,000
Neversweat.....	120 "	100,000
Moffat.....	50 "	90,000
Tinker.....	140 "	120,000
Watty.....	100 "	130,000
	1,340 "	\$1,440,000

In Cariboo district, even to the present time, the prices of labour and supplies have never been lowered to a point at which it would be profitable to work any but the richer deposits, which in the nature of things bear a small proportion to those capable of yielding a moderate or small amount of gold; and in working over the deep ground in early days much was left that would even now pay handsomely, but cannot be found or reached on account of the treacherous nature of the moved ground, filled with old timbering and water. On both Williams and Lightning Creeks, but particularly in the former, there must be a great quantity of gold in ground of medium richness even yet. To render this gold available, however, and to prove successfully the lower and more difficult parts of the valleys, greater and more exact engineering knowledge, better and larger machinery, and, above all, cheaper labour and supplies, dependent on greater facilities of transport, such as would result from railway connection are required. The most important works of a general kind, which have so far been carried out in Cariboo District, are the Bed-rock Drain and Bed-rock Flume, on Williams Creek. The first of these is a tunnel which runs through all the old deep workings, beginning at the lower end of the part of the creek called "The Canon" (about 1,000 feet above Barkerville) and running out in "The Meadows." The total length of this tunnel is about one and one-eighth miles, and the cost of its construction is estimated at about \$100,000. The flume, constructed in 1865, begins about 1,000 feet above the head of the drain, at the upper end of "The Canon." It is a cutting averaging about twenty feet in depth and a mile in length, and is estimated to have cost about \$250,000. Into it the small flumes of the various companies working along the creek discharge, and it has also served for the working of the ground belonging to the Flume Company. By means of the free drainage afforded by these works a great part of the later mining has been rendered possible. As an illustration of what might be done in this way, it may be mentioned that it has been suggested that by cutting a flume to Antler Creek—part of which would require to be a tunnel—free drainage of the whole upper part of Williams Creek would be obtained, and, if the grade should prove to be sufficient on survey, it would enable the valley, from its sources to

the flume level, with all its old workings, and the great depth of tailings holding more or less gold which has accumulated, to be completely stripped by extensive hydraulic works.

In the above general notes on Cariboo district, Williams and Lightning Creeks have been particularly referred to as exemplifying the conditions there found, and the methods employed in working the old deep channels.

These two creeks have, besides, yielded by far the greater quantity of the gold, and on them the pre-glacial channels have been found to be continuous, and, though deep, specially well adapted for working. Underground drifting on old channels has, however, been practised, as well as several other creeks, of which Keithly, Harvery, Grouse and Mosquito creeks may be specially mentioned. There are besides a number of creeks which have yielded much gold by surface work or in open sinking of moderate depth, portions of which still remain, which it is confidently believed by miners would prove rich in deep ground if properly explored. Antler, Cunningham and Jack-of-Clubs creeks, with Willow River, are supposed to be specially promising from this point of view, and, though attempts have been made from time to time to test the deep ground on several of these, it has not yet been successfully accomplished. On Antler Creek in particular the Mason Company has been at work with this object for a number of years, and has not yet abandoned the efforts.

Approximate statement of value of gold produced by Cariboo District from 1874 to 1888:—

1874 (partial).....	\$ 700,000
1875.....	1,075,237
1876.....	646,000
1877.....	411,402
1878.....	380,535
1879.....	500,000
1880.....	564,000
1881.....	610,737
1882.....	471,525
1883.....	457,787
1884.....	423,855
1885.....	347,700
1886.....	288,300
1887.....	247,673
1888.....	250,377

The amounts above assigned to the various years are merely approximate, particularly for the earlier years of the series, the returns for which are extremely imperfect. The table as a whole, however, illustrates the large amount continuously afforded by the Cariboo district from a period beginning more than ten years subsequent to its discovery, and after the most productive years had passed. It also evidences the gradual falling off in yield, which has been nearly continuous since the richer portions of the deep channel of Lightning Creek have been worked over.

The Capelton Chemical and Fertilizer Works.

Leaving Sherbrooke by the 9 a.m. B. & L. train (which, by the way, is not remarkable for rapid transit but, as the genial conductor says, it teaches patience) we proceed towards our destination. Nearing Capelton we see in the distance the extensive chemical works of Messrs. G. H. Nichols & Co. comprising Sulphuric acid, Fertilizer and Smelting works, occupying the site of the old G. W. Brooks' farm-house. We are struck by the practically entire absence of sulphurous gas which is usually seen emanating from establishments of this character. Getting off the train at Capelton station we walk to the spacious offices of the company, only 100 feet away. We notice with pleasure the convenient arrangement and neat finish of these offices. Here we find everything that conduces to health and comfort, combined with excellent facilities for conducting the business of the various departments—characteristic of the regard which the Messrs. Nichols have for the comfort and convenience of their employees in charge of their extensive establishments. Away in the distance up the hill we can just see the towers, smoke-stacks and roofs of the substantial mine-buildings of the company, of which we intend to give our readers a description at some future day.

Accompanied by the Superintendent we gain admittance to the sulphuric acid works. The first building we enter is the burner-shed, where is the handsomest and largest battery of burners of the Melétra-Herreshoff style, in America. Here the green-ore (the product of the Albert mine) is burned; the fumes, which pass off in the form of sulphurous acid gas going directly into an improved style of Glover tower, the invention of Mr. J. B. F. Herreshoff, A.M., Superintendent of the Laurel Hill chemical works,—the property of the company.

From the Glover, or concentrating tower, the burner gas passes into the great leaden chambers, where all the sulphuric acid is made. In this weak condition it is known as chamber-acid, which, for commercial use, must be further concentrated and purified.

Dr. Lungé says: "The introduction of lead chambers is, by general consent, ascribed to Dr. Roebuck, of Birmingham, who, in 1746, built such a chamber six feet square, and a few years afterwards constructed a factory in order to supply acid for bleaching linen."

At the present day these lead chambers are erected of immense size, some of them having a capacity of one hundred and forty thousand cubic feet. Here, at Capelton, we find a dozen or more of these huge lead chambers, looking like great boxes, formed, top, bottom and sides, of heavy sheet lead, rolled specially for the Messrs. Nichols, and supported by heavy wooden frames.

Sulphuric acid, which, at the close of the eighteenth century, cost for commercial use, in large quantities, upwards of fifteen cents per pound, is now turned out and sold in car-load lots here at Capelton, in quality unexcelled, for about one-ninth of that price.

This is partly due to the fact that up to the last fifty years only brimstone was used (principally from Sicily), while at the present time pyrites forms one of the principal sources of the sulphur used in sulphuric acid manufacture, and partly to the great strides that have been made in the art.

It is conceded by noted European authorities that the appliances used and the methods pursued by the Messrs. Nichols at their factories, represent the most advanced state of the art of sulphuric acid manufacture in the world.

Many of our readers will doubtless ask what is sulphuric acid, and what it is used for in such large quantities?

To the first question we would answer briefly, and avoiding technical terms, that it is a combination of oxygen, sulphur and hydrogen.

To the second, we would reply that a few of the most important applications of sulphuric acid, are, for making muriatic acid, soda-ash, bleaching powder, soap, glass, for making superphosphate and other fertilizers, for preparing nitric, phosphoric, hydrofluoric, carbonic, chromic, oxalic, citric, acetic, and other acids. For cleaning sheet iron to be galvanized, for working galvanic cells, for making many organic coloring matters, for purifying many mineral oils, for effervescent drinks, for destroying vegetable fibres in mixed fabrics, for drying air (principally in the laboratory), for making shoe blacking, for dissolving indigo and for numerous other productions. Indeed so largely does this acid enter into the arts and manufactures, that one of England's greatest statesmen, Lord Beaconsfield, better known as Benjamin Disraeli, has said that the state of a country may be very well judged by the amount of sulphuric acid it consumes.

From the chambers the remaining gases pass into large circular tanks called Gay-Lussac towers after the famous chemist of that name.

In the burner-shed are situated the platinum stills, in which the concentrating of the acid is done. These stills, unique in style, are also the invention of Mr. Herreshoff.

From the stills comes a limpid stream of chemically pure acid, running rapidly, yet one is inclined to think that it is glass, so clear and steady it is, reminding us of its commercial name, "oil of vitriol." From the stills the acid is conveyed in pipes to enormous tanks, where it is stored ready for market.

Immediately west of the burner-shed is the stock room, where acid of different grades is kept, and where the old fashioned carboys and drums are filled ready for shipment.

The favorite method of putting up the acid for transportation is to run it into large tanks on platform cars, thus obviating the expensive handling of a hundred carboys, which are so fragile that, notwithstanding the most improved methods in use and care in packing, breakages occasionally occur.

Adjoining the burner-shed on the east, stand the smelting works, to which the ore from the burners—now deprived of its sulphur—but still containing the copper, is carried by a series of conveyors and elevators of improved design.

The cupola is a Herreshoff water jacketed furnace. By this smelting process the resulting matte carries about fifty per cent. of copper; the other principal constituents being iron and sulphur. This matte or regulus, is at present shipped to Great Britain, where it is made into ingot copper. The furnace above referred to, is compact, symmetrical, and very efficient. At night the smelting works possess peculiar attractions. As the steady stream of molten slag pours over into the iron pots placed to receive it, it casts a ruddy glow on the faces and brawny arms of the workmen and the whole building is aglow with the same enchanting light. Presently we hear the furnace men cry out "copper!" This is the signal for a few minutes of exciting work. It means that the copper matte has collected in the well or fore hearth to that height at which it is drawn off. One of the workmen dons a heavy leather coat to protect him from the sparks and tiny pieces of melted matte that dance and fly in all directions on coming in contact with the least moisture. Two other men seize heavy sledges, while a third snatches up the tapping-steel, which he holds against the clay that

keeps back the metal, while the men with hammers drive in the steel; a fifth man runs back to a large iron pot to receive the matte, as it belches forth in an incandescent stream, sending sparks in all directions.

The "slag," or dross (the principal constituents of which are, iron, silica and alumina), runs from another outlet into large iron pots called buggies, and is wheeled away out of the building, where it is dumped in the molten state, solidifying as it cools, into one compact concrete light mass.

A few hundred feet south from the Chemical Works, close to the main line of B. & L. Railway, stand the Fertilizer Works, where are compounded the several grades of complete plant food, so well and favourably known to our farmers. One of the principal ingredients, the phosphate of lime, or apatite, is brought here from the North Star mine in the Buckingham district, Que. Here it is first dried, and ground in a large Griffin mill, an ingenious machine in which centrifugal force and rotary motion combined, are utilized. The apatite, after it has been ground to an almost impalpable powder, is conveyed by machinery to another part of the buildings, where it is treated with sulphuric acid. This process renders available a very high percentage of phosphoric acid. To this acid-phosphate are added the other chemicals that conduce to the growth of plants as may be required to adapt the complete manure to different soils. After passing through various mills and mixing machines, it is put up in sacks of 200 lbs. each, neatly branded.

The machinery, which is of the most improved design in this building, is admirably adapted to the work.

So thoroughly satisfied are agriculturists who have used the manures made here, that it is quite unnecessary for us to extol the merits of any of them.

Having now "done" the establishment, we stop for a moment to get an adequate idea of the proportion of the business of these chemical works.

Few of our readers know how important that little post village, Capelton, is; and to give a rough idea of the huge scale on which operations are carried on there we will put down some figures.

In the construction of the buildings, which are well designed and thoroughly substantial, upwards of three-quarters of a million feet of lumber were used.

The floor space in the various departments amounts to upwards of two acres.

All the buildings are clapboarded and painted.

The surface painted amounts to over one and one-half. The lead-work which we have described comprises about 500 tons of this metal.

The company are now doubling their capacity, but already their acid works are three times as large as anything of the kind in the Dominion, and their capacity is sufficient to supply the demands of this now rapidly developing country.

Only three years ago the site on which these works are erected was almost a mudhole, and to-day it is the scene of one of the greatest and most important industries in Canada.

Messrs. G. H. Nichols & Co. are, and have for some years, been the leading manufacturers of sulphuric acid in America, and their works at Laurel Hill, Long Island, N.J., are the largest and most complete of the kind on the continent.

Masonry Supports in the Tilly-Foster Iron Mine.

Mr. L.G. Engel has published a very elaborate paper on this subject. The method of working the deposit, he states, was formerly by stalls driven along it, with pillars left to support the roof; but a cave occurred, compelling the adoption of a new system of mining. At intervals of 100 feet levels are driven from the shaft completely round the ore body, with the foot or hanging wall forming one side of the level. Stalls are driven through between the level at the foot wall and the level at the hanging wall, and they are then raised until they are within 25 feet of the level above. The hanging wall is 80 to 160 feet from the foot wall, and is supported by pillars representing 75 per cent. of the deposit. The plan adopted to support the hanging wall, while the pillars are being removed, is that of building with concrete raised on arches thrown from the wall, to an extent sufficient for the support of the hanging wall. The severity of the frost in winter will not permit concrete to be made at the surface. The concrete consequently is mixed underground and raised to its position when the arches are built. The first arch built had a span of 90 feet, with a rise of 15 feet. It was built of brick and made 3 feet in depth. A shaft is left in the arch and concrete above, through which materials are raised by steam power from the mechanical mixer placed under the arch. In order to avoid the interference with the workings of ore in the lower levels, the first pillars were built above the 300 foot or highest level off the shaft; but a continuous pillar will afterwards be raised from the 500 foot level up under one already built, thus forming a solid mass of concrete 300 feet in depth, and 1,700 feet in horizontal sectional area over an arch at the 500 foot level. The estimated cost amounts to 46 cents per ton of ore recovered.

The new Dressing-Works of the St. Joseph Lead Company, at Bonne Terre, Missouri.*

By H. S. Munroe, School of Mines, New York City.

The dressing-works of the St. Joseph Lead Company were destroyed by fire, February 26th, 1883. Within about four months, or on July 5th, 1883, the new mill, with a capacity of 500 tons per day, was built and in active operation. The capacity of the new mill has since been increased to 800 tons per day.

The old mill was built in 1867, by Mr. C. B. Parsons, the present superintendent. It was a curious rambling old structure, which had grown with the demands of the business; a few jigs having been added in one place, a table or two in another and wings and sheds added to the main buildings, from time to time as it was found necessary to increase the efficiency or the capacity of the mill. The old mill was, moreover, a most interesting place to the student, a perfect "museum of ore-dressing." Nearly every form of dressing apparatus known to the art had, at one time or another, found a place under its roof, jigs of many kinds, concave, convex, side-bump and stationary tables, tyes, buddles, dolly-tubs, etc., etc. The method of dressing followed in the main the lines of English practice, but with many modifications, both in the machinery and the methods of working, due to the

inventive genius of Mr. Parsons. At one time, however, the mill was surrendered to a German expert, of acknowledged ability, and the Continental system of dressing was given a fair trial, with its numerous sizing-drums and jigs with varying speed and stroke adapted to each ore-class. Different forms of crushing apparatus were tried and the best method of handling the ore and the different products of the mill, was carefully worked out.

The new mill represents, then, the results of fifteen years' study and experiment in the old structure, and is a shining example of the "survival of the fittest" both in apparatus and in methods of treatment.

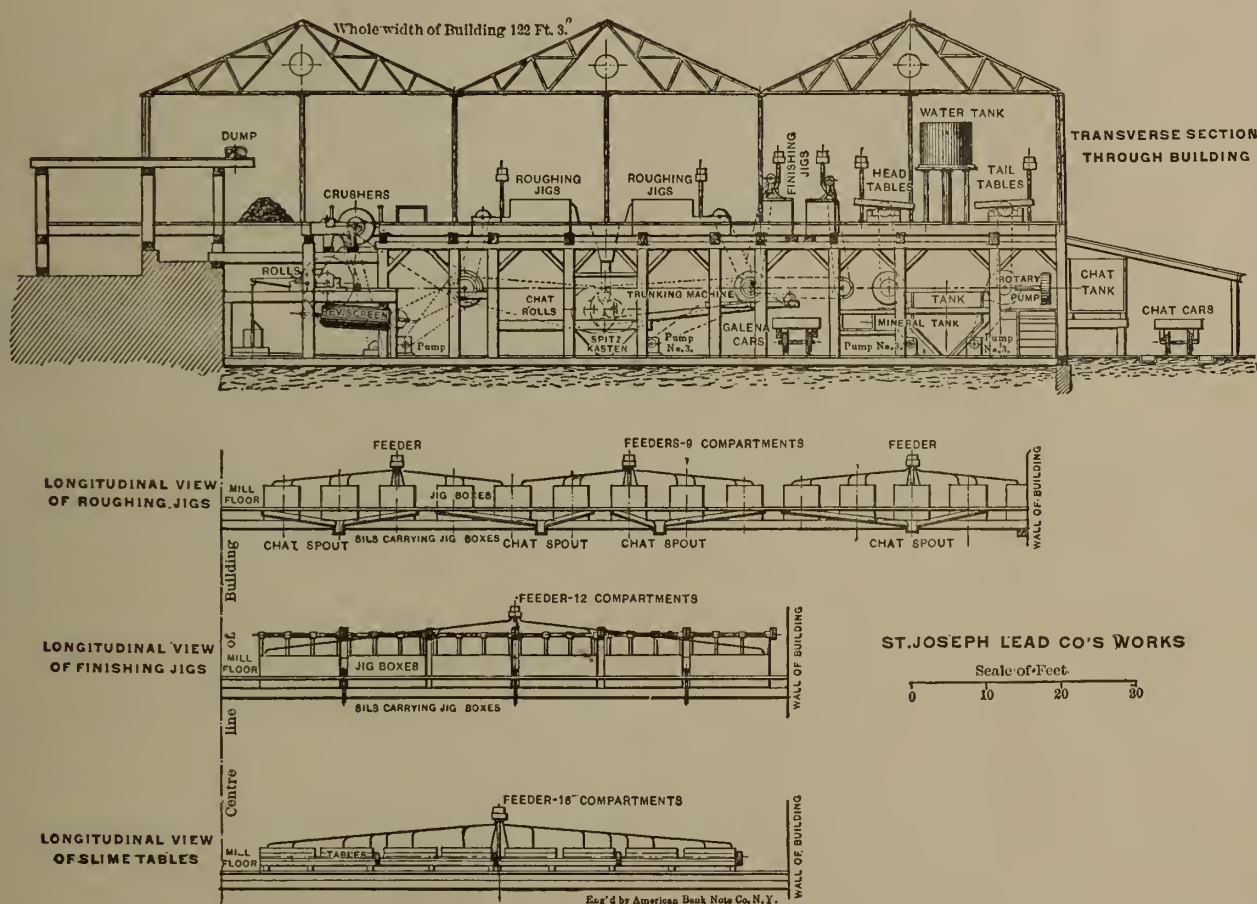
The salient features of the new mill are: first, the method of treatment, which follows English rather than German precedents; second, the dressing apparatus, which has many novel features; and third the construction and arrangement, and the methods of handling the ore and mill-products, which are quite unique.

The work of dressing is carried on at Bonne Terre under special difficulties. For many years the only water-supply has been the rainfall of a basin about a square mile in area, the water being collected and stored in a reservoir formed by a dam across the little valley. The water is used over and over again, the portion heavily charged with slime being allowed to escape into a small settling pond, from which it is again pumped into the mill. The only water lost is that carried off in

the wet sand and that lost by evaporation. This loss is made good by drawing small quantities from time to time from the reservoir.

The disposal of the waste sands or "chats" is also a matter of some difficulty. Until recently the company had no dumping ground available near the mill, which fact, with the lack of water, made it impossible to run off the sand by launders in the usual way. Resort therefore was had to the plan of carrying off the sands in railroad cars designed for the purpose. In the old mill these cars were loaded by bucket-elevators, but in the new mill special "chat" tanks have been introduced for the purpose. The water which drains from the cars runs into the settling-pond and is saved. The "chats" are used for grading, for railroad embankments and ballast, and recently in the construction of a new dam made necessary by the undermining of the old reservoir. The bulk of the sands are dumped in the valley above the dam, so that the water which they still retain drains out and eventually finds its way into the reservoir. By a recent consolidation, these disadvantages have been removed in part. The company now owns a large pumping-plant on Big river, about three miles away, and only the additional water-supply so gained has made it possible to continue work through the severe drought of the past season. A more convenient dumping-ground for the waste sands, also has been secured.

PLATE II.



The ore is galena, associated with some iron pyrites carrying traces of nickel and cobalt. The mineral is disseminated in a magnesian limestone in irregular segregated deposits of large size. Formerly it was supposed that these deposits occurred in definite "ranges" and at certain horizons only, but further exploration with the diamond drill has proved the existence of ore-bodies over the whole area prospected, nearly a square mile, and through a thickness of over three hundred feet of limestone. The deposit is worked by enormous chamber-workings, supported at intervals by heavy pillars. Underhand stoping is employed and the ground is broken with machine drills and high explosives. Formerly small diamond drills were used for boring the blast-holes, and very deep holes, thirty feet and more, and heavy charges of explosive were employed. The recent advance in the price of diamonds has made necessary the introduction of percussion-drills; and the excessive amount of block-holing, incident to the large blasts, has caused the employment of blast-holes of more moderate depth. Owing to the large size of the workings, the cost of breaking ground is quite low. The rock is loaded in small iron cars, hauled by mules, and brought to the surface through vertical shafts.

The main shaft is close to the mill, and the cars are run by the launders into the dumping-cradles above the crushers. The minecars from the more distant shaft are

brought to the mill on special platform cars by switching-engines. These platform cars hold twenty mine-cars each and there is a sufficient number of them to avoid delay.

Outline of Method of Treatment.

The method of treatment may be outlined as follows: The ore is crushed by jaw-crushers and rolls, and screened dry through a 6 mm. screen. The sands passing through the screen are thoroughly mixed with water and elevated by centrifugal pumps to distributors and divided among the Parsons jigs, without any previous sizing or classification. The tails ("chats") after passing over the two sieves of these jigs receive no further treatment, and are conveyed by launders to the "chat-tanks." Coarse galena and raggings are skimmed by hand from the jigs at intervals, leaving always a sufficient bed to ensure good hutchwork. The hutchwork which comes through the sieves of the Parsons jigs pass through a series of spitzkasten. The heavy galena, mixed with some sand and slime, settles in the first box of the series from which it is fed to a trunking-machine. The pure galena from this machine falls into railroad cars and goes to the smelting-works. The tails from the trunking-machine, together with the sands settling in the second box of the spitzkasten, are elevated by centrifugal pumps and divided between the Hartz three-sieved jig. The tails of the Hartz jigs receive no further treatment,

going directly to the chat tanks. Galena and pyrites are skimmed from the sieves of these jigs. A bed of galena is, however, maintained on all three sieves so as to ensure a rich hutchwork. The hutchwork of these finishing-jigs is nearly pure galena, and goes to galena-boxes on the lower floor, which are emptied from time to time, and the galena loaded on cars to go to the smelting-works.

The fine slimes settling in the third and fourth boxes of the spitzkasten are united and raised by centrifugal pumps to the distributors feeding the first row of Parsons Rittinger tables. The middlings from these tables are treated on the second row of tables. The tails from all the tables flow into the chat tanks, and the heads run into galena-boxes on the lower floor from which they are loaded into cars.

The raggings, containing from 12 to 20 per cent. of lead, which are skimmed from the Parsons jigs, are re-crushed by fine rolls and elevated without screening to a line of Hartz three-sieved jigs. These raggings contain considerable pyrites.

Arrangement of the Mill

Plate I. gives a general plan of the mill and Plate II. a transverse section. The mill is a two-story structure. On the main floor are the ore-bins, the roughing-jigs, the finishing-jigs, and the tables. All the work requiring abundance of light and careful supervision is concentrated

on this floor. The entire absence of overhead machinery, screens, shafting and belting, classifying-tanks and launders is very noticeable. There is nothing to intercept the light falling on the jigs and tables, and the whole floor is so open that supervision is rendered much more effective. The roof is a mere umbrella of corrugated iron, with light iron trusses and supported on slender columns. All the heavy weights and jarring machinery are as near the ground as possible. The roll screens, centrifugals, pumps, spitkasten, chat-tanks and galena-boxes are on the lower floor near the ground. The shafting, gearing, pulleys and belting are all below the main floor.

This arrangement has many advantages. It is cheap; the heavy framing being confined to one story. It is strong and durable; the jar of the moving machinery, crushers, jigs, and tables having but little effect on such a low, flat and strongly-braced structure. All the classifying-and settling-tanks, with the enormous weight of water which they contain, rest directly on the ground. Finally, the absence of overhead machinery and apparatus, besides increasing the light and facilitating superintendence, lessens materially the risk from fire, there being absolutely nothing to burn above the main floor of the mill.

The main disadvantage attending the arrangement of the mill in two floors, as described, is the necessity for elevating the material to be treated several times. This

is accomplished, at Bonne Terre, by the use of centrifugal pumps by which the sands are elevated *with the feed-water* required for the proper working of the various jigs and tables. It should not be overlooked, however, that the bulk of the material is elevated but once. After passing over the roughing-jigs, 600 tons of waste sand go at once to the chat tanks. Of the remaining 200 tons, 74 tons are mineral and ragings, and 20 tons escape with the overflow of the spitkasten, leaving only 106 tons to be elevated again. The average lift of the 800 tons raised by the centrifugal pumps, including that which has to be elevated a second time, is less than thirty feet. If a mill of several stories like an anthracite breaker, or one arranged in steps or terraces like the Lake Superior mills, had been built at Bonne Terre, it would have been necessary to deliver the ore at a level at least forty feet higher than at present, involving a much more expensive building, and increased cost of hoisting, forty feet instead of thirty, for the whole 800 tons, merely to save the elevating of 100 tons a second time.

Again, if the mill had been built in several stories both the wash-water and feed-water for the different machines would have to be raised about twenty feet higher than at present, and as twenty-nine tons of water are required to treat one ton of ore, this additional lift would be a serious matter.

In round numbers the saving by the present arrange-

ment amounts to about 520,000 foot-pounds per day, or over 20 horse-power.

Lighting of the Mill.

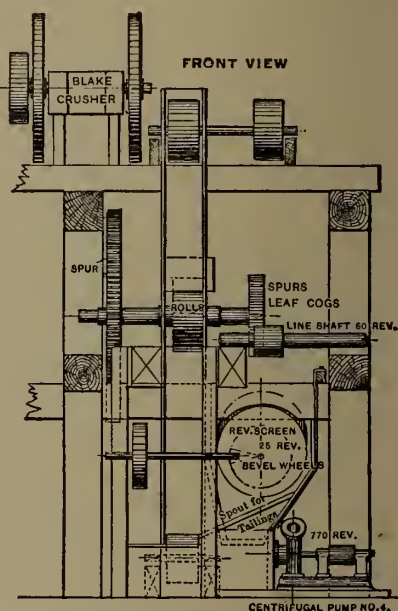
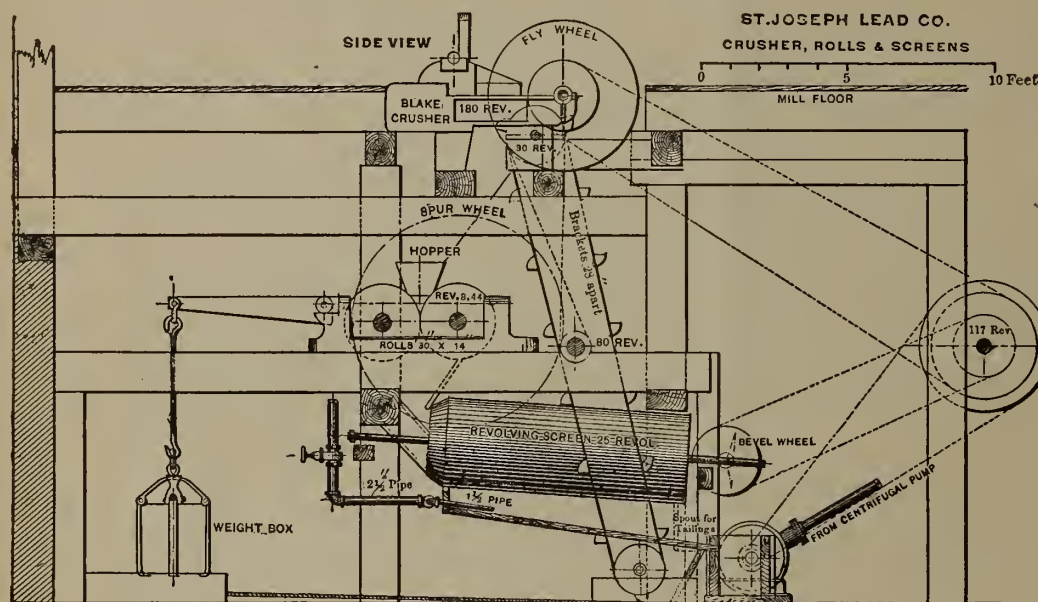
The mill is lighted by numerous large windows in the side walls, and by nearly one hundred large sky-lights of heavy glass inserted in the roof. At night the necessary light is furnished by numerous incandescent electric-lamps, those near the feeding platforms, which are liable to be struck by flying bits of ore, being protected by heavy wire-cloth.

Crushing of Ore.

There are ten sets of crushing and screening apparatus in the mill, each crushing about 80 tons in twenty-four hours, consisting of a 7' x 15' Blake crusher, lever pattern, with corrugated jaws; a pair of Cornish rolls, 14" x 30", with chilled tires; a revolving screen, 3 feet diameter by 8 feet long, with 6 mm. perforated steel-plates, a bucket-elevator for the material coarser than 6mm., and a centrifugal pump.

The jaw crushers are set to crush to about 38 mm., or 1½ inches, and the rolls to crush to about 16 mm., or ¾ inch. Of the material passing through the rolls at any time, about one-third is too coarse to pass through the screen, consequently the ore passes through the rolls one and a half times. While the perforations of the screens

PLATE III.



are 6 mm. in diameter, not more than 2 per cent. of the screened product is coarser than 4 mm.

The crushers are fed by hand, one man to each machine. Care is taken to have the feeding regular, as on this depends the amount of material going over the jigs, tables, etc., which must be kept uniform.

Some interesting data were obtained as to the fineness of the ore at different stages of crushing, samples having been sifted through sieves of different mesh and the percentage of each size computed.

Size.	Average of Ore from Mine.	Product of Blake Crusher, crushing		Product of Rolls.	Screen'd Ore Average
		Rich Lumps.	Lean Nut Ore		
Above 38 mm.....	61.3				
16 mm. to 38 mm....	23.2	67.7	75.2		
4 mm. to 16 mm....	7.5	20.7	18.9	35.2	2.0
1 mm. to 4 mm.....	4.9	8.6	4.4		41.0
¼ mm. to 1 mm.....	1.6	.8	.4		27.0
Below ¼ mm.....	1.5	2.2	1.1		30.0
	100.0	100.0	100.0	100.0	100.0

It will be seen that of the ore coming from the mine, nearly 40 per cent. is as fine as if it had passed through the jaw-crushers, 15.5 per cent. is as fine though it had passed through the rolls, and 8 per cent. is fine enough for the jigs. This latter portion is very rich, containing over 20 per cent. of lead, while the average richness of the ore is about 8 per cent.

Two experiments were made with the Blake crusher; the first with large lumps of rich ore, the crushing of which should give a maximum of fine stuff; and the second with small pieces of lean ore, which should yield a minimum of fine stuff. The jaws were set to crush to 38 mm. or 1½ inches. About one-third the product in first

case, and one-quarter in the other was as fine as though it had passed through the rolls. But little fine stuff, less than 1 mm., was made in either case.

The figures in the last column show the average composition of the crushed ore after it has passed through the 6 mm. screen, and as it goes to the jigs. It will be seen that the rolls produce a large proportion of fine stuff. The losses in the treatment of this fine stuff are very great. Its production could, perhaps, be lessened somewhat by some changes in the arrangement of the crushing machinery, but it is evident that some better form of crushing-apparatus than rolls, is urgently needed for such fine comminution as is required at these works.

Of the 30 per cent. of stuff, less than ¼ mm., there is produced:

In the mine..... 1.6 per cent.
By the crushers..... .8 per cent.
By the rolls..... 27.6 per cent.

Total (as above)..... 30.0 per cent.

The experiment of using coarser screens than 6 mm. has been tried without success, the losses from included mineral being much larger. It is proposed to make a trial of other forms of crushing-apparatus, the results of which will be of great interest. Since a machine for fine crushing, that will produce a minimum of slime, of large capacity and economical, is much needed, a promising field is open to inventors.

In crushing 224,203 tons of rock in 1886-1887, an average of 8 sets of crushing apparatus being in operation, the following new parts were required:

For the crushers:
12 levers at \$25.00.....\$300.00
9 jaw-plates at \$15.00..... 139.50
12 jaw-plates at \$12.00..... 144.00
Toggles, check-plates and sundries.... 247.80

Total.....\$831.30

or an average of about \$100 for each crusher. This does not include the cost of babbitting the bearings nor labor in making repairs.

For the rolls:

7 pairs tires at \$120.00.....\$ 840.00
Gear-wheels and pinions..... 335.00

Total.....\$1,175.00

or about \$147 for each pair of rolls. The tires of the rolls used for coarse crushing are not turned when worn, but are replaced by new ones. The tires of the fine rolls are kept in good condition.

For the screens, 21 sets of perforated plates at \$60.75, equal to \$1,275.75, were required, or an average of 2.6 sets per year for each screen.

The average life of the wearing parts of a jaw-crusher is therefore about 8 months; each set of chilled tires on the rolls lasts about a year; and a set of screen plates about 4 months.

Centrifugal Pumps.

The centrifugal pumps, used for elevating water and sand together, are made under the Heald & Cisco patents, by the Morris Machine Works, Baldwinsville, New York. They are made somewhat heavier than for ordinary work, the metal in the pan, for example, being ¾ inch thick. No attempt is made to repair the pumps. Usually the pan and shell are worn out in about the same time. The work of replacing an old pump by a new one takes an hour to an hour and a half. When the centrifugal pumps were first used for pumping coarse sands, a new pump lasted about three weeks, but by increasing the thickness of the wearing parts the life has been prolonged. It is possible that by lining the pumps with rubber, as is sometimes done in the case of centrifugal machines of the type used for dredging, the pumps might be made still more durable. The average life of one of these pumps is 100 days.

The smaller pumps (3-inch) used for elevating the fine sands and slimes last much longer.

An incidental advantage from the use of centrifugal pumps is the very thorough mixing of water and sand, a matter of some importance, because the ore is crushed and screened dry and only mixed with water just before entering the pump. By this thorough mixing the percentage of float-mineral is undoubtedly diminished.

The sand and water is conveyed to the distributors feeding the jigs by 4-inch extra heavy gas pipe, which lasts about two years. Any change in direction is made by bending the pipe with as long and gentle a curvature as possible. The 3-inch pipes, conveying the fine sands and slimes, have been in use over four years, or since the building of the new mill, and are apparently still in good condition.

The Parsons Feeder.

A simple and effective device, shown on Plates IV. and V., is used to sub-divide the sands or slimes, elevated by a single pump, among a number of machines, jigs or tables. A satisfactory method of doing this, so as to secure an equal and uniform distribution, without any concentration or classification of the sands on one machine at the expense of the others, has been for a long time a great desideratum in dressing works. The ingenuity of Mr. Parsons has furnished a very satisfactory solution of this difficult problem. The feeder or distributor is a casting at the top of the pipe from the centrifugal pump, divided by partitions into a number of radial boxes, which surround the delivery pipe and are connected therewith by vertical slots of uniform size. By increasing the number of radial partitions the streams of sand or slime can be sub-divided to any desired extent. From the bottom of each of these boxes a pipe conveys the sand or slime to the jig or table.

When it is necessary to shut off the supply temporarily from one jig or table, its box in the distributor is filled and the opening closed with a piece of cloth, which for convenience in handling, is fastened to an iron rod with a loop-shaped handle. The distributors are made of cast iron, and are quite durable. Those now in use have required no repairs since the mill was built, 4½ years ago. The pipes leading from the distributors to the jigs must be renewed occasionally.

Roughing-Jigs.

Plate IV. shows the details of the Parsons jig, used for the preliminary jigging. It is a two-sieve under-piston jig, each sieve 24" x 39" (or 22" x 27" in the clear.) The piston is vertical 1½" in diameter, and moves in a short horizontal cylinder, 4½" long in the partition between the two jig-boxes. The piston-rod is horizontal and enters through the stuffing-box. For convenience the jigs are made double, i.e., four sieves or two jigs, are united in one machine. One great advantage of this form of jig is the small floor space occupied by a large number of machines, the whole area of the jig-box being available for jigging. The stroke of the piston is 2 inches, and the number of strokes per minute one hundred and fifty. The quantity of under-water required is about two cubic feet or 16 gallons per minute. The consumption of feed-water is 16 to 18 gallons per minute, containing about 13 pounds of sand (dry weight). There are nine jigs, 4½ machines, for each set of crushing apparatus. Each jig treats, therefore, about 9 tons per 24 hours, or less than one-third the capacity of a jig of equal area according to data given by Rittinger, so that the mill has ample jig capacity.

In the Lake Superior copper mills the tendency, of late years, has been to increase the number of jigs, in the attempt to lessen the losses in the tailings. The St. Joe mill has, however, a larger jig capacity, in proportion to the rock crushed, than any of the Lake Superior mills. For the treatment of 800 tons of material per 24 hours there are 252 jig-sieves. The best equipped mill in the Lake Superior region would have on the same basis, but 224 sieves. The rough sands at the St. Joe mill are divided between 90 sieves, or 9 tons per 24 hours to each. In the Lake Superior mill alluded to there would be but 60 sieves for the same mill capacity. At Lake Superior, however, about 45 per cent. of the ore is separated in the classifiers as slime, and goes directly to the tables. This reduces the average amount of sand treated on each jig to 7½ tons per 24 hours. On the other hand, the sands are very unequally divided, so that some of the jigs treat over 10 tons per 24 hours, and others as little as 5 tons. These latter jigs treat very fine stuff, and at 5 tons per 24 hours are really worked to their full capacity. The loss on these jigs is fully as large as on the coarse jigs, notwithstanding the greater fineness of the material, and the smaller quantity of included copper present.

Experiments made by the writer, about two years ago, at one of the Lake Superior mills, seemed to indicate that the capacity of the mill could be increased fully 50 per cent., and this without increasing the losses, simply by making but two grades of sand in the classifiers instead of four. The practice at the St. Joe mill, when no attempt is made to classify the material before jigging, and when, consequently, sands and slimes are treated together on the same jigs, represents a further and extreme step in the same direction. The results obtained

by this novel procedure are opposed to our preconceived ideas and accepted theories on the subject of jigging, and the St. Joe practice is certain to have important influence in modifying jigging methods in the future. The results obtained, it is true, are not wholly satisfactory, the loss of galena in the very finest slimes being large. In other respects, however, the method has many advantages, and the loss in the fine stuff can be brought within reasonable limits by simple modifications in the methods of treatment, which will be discussed further on.

During the past year the writer has had the opportunity of studying very carefully the working of these jigs. A large number of samples were taken, and several hundred assays made under his direction. In order to determine the action of the jigs on the coarse and fine grades of sand and slime, samples of the material treated, of the tailings, and of the hutchwork were subdivided by sifting, and the different portions assayed separately. From the results of the sifting and from other data, it was possible to estimate the proportion of sand and slime of different grades passing through the jig-sieves into the hutch-work, and the proportion of each size which passed over the sieve and into the tailings under different conditions.

The following table contains typical assays of the material treated and of the products of jigging:—

Size.	Percentage of sand of each size.	Lead in Ore. Per cent.	Lead in Hutchwork Per cent.	Lead in Raggings. Per cent.	Lead in Tails. Per cent.
1 mm. to 6 mm.....	41.1	6.32	....	16.20	1.06
¼ mm. to 1 mm.....	29.6	9.10	....	74.0	.96
⅛ mm. to ¼ mm.....	9.3	13.81	19.2	....	.71
1-12 mm. to ⅛ mm..	1.5	12.93	14.8	....	1.09
1-20 mm. to 1-12 mm.	2.2	7.84	8.8	....	1.74
Below 1-20 mm.....	16.3	12.22	16.4	....	6.07
Average.....	100.0	8.93	22.3	16.54	1.53

From the assays of the different portions of the ore it will be seen that the stuff less than ¼ mm. is richer than the average, while the portions coarser than ¼ mm. are poorer. This is due to the friability of the galena, which is crushed finer than the gangue.

The hutchwork is quite poor, containing but 22.3 per cent. of lead. This is due to the large proportion of partially concentrated fine stuff, less than ⅛ mm., about two-thirds of which passes into the hutchwork. This fine stuff is separated by the trunking-machine and the pointed-boxes, and concentrated on the finishing-jigs and tables.

The assays of the several portions of the jig-tailings show very closely the limits within which the jigs are doing good work. It will be seen that the amount of lead in the tailings decreases with the fineness of the sands down to ⅛ mm. A careful examination of these coarser sands will fail to show any free mineral, the lead being present as included galena. The finer the comminution the smaller the amount of such included mineral, and consequently the poorer the sands. Below ⅛ mm. the tailings increase in richness, which is due to the presence of free galena. The loss from this cause is not serious, save in the portion finer than ¼ mm.

It will be seen that the plan of jigging sands and slimes together, makes it possible to treat very much finer material with success than has heretofore been supposed possible. The limit for successful work on jigs is generally placed at about 1 mm. The successful jigging of stuff ⅛ mm. and less, marks a decided advance in the art of dressing. The coarse grains form the interstitial channels* in which this very fine stuff can be concentrated. It is well known that any attempt to treat stuff finer than 1 mm. by itself results in a very imperfect working of the jigs, the losses being large, and the capacity of the jigs small.

The great advantage of this system of jigging is the large proportion of sands successfully treated and finally disposed of by the roughing-jigs alone. Out of 800 tons per day, only 136 tons require further treatment, viz., 30 tons raggings, crushed and treated on the three-sieve jigs, 66 tons fine sand, also treated on three-sieve jigs, and 40 tons of slimes treated on the side-bump tables.

The sole disadvantage lies in the difficulty of forcing all the very finest slimes to go through the jig-sieves. Under normal conditions about 40 per cent. of the stuff below ¼ mm. passes off with the tailings. Even this very fine stuff is somewhat impoverished by the action of the jigs, and of that which escapes, a very large proportion is too fine to be saved by any form of apparatus, so that the final loss from this cause is not as serious as might at first appear.

The jigs are run with a long stroke, and with as little feed-water and under-water as possible, in order to carry the larger proportion of the fine stuff through the jig-sieve.

It is possible, by lessening the amount of feed-water and under-water, to cause a larger proportion of this fine stuff to pass through the jig-sieve, but at the expense of forcing through, at the same time, much coarser material,

and thus sending to the finishing-jigs material that can be treated successfully on the roughing-jigs. The following table shows the effect of reducing the amount of water used in jigging, the percentage of hutchwork and tailings with the normal and with reduced quantities of feed-water and under-water being placed side by side for the different sizes:—

	Above ¼ mm.		⅛ to ¼ mm.		1-20 to ⅛ mm.		Below 7-20 mm.	
	Normal.	Reduced.	Normal.	Reduced.	Normal.	Reduced.	Normal.	Reduced.
Hutchwork.....	26	39	68	94	67	93	60	83
Tailings.....	74	61	32	6	33	7	40	17
	100	100	100	100	100	100	100	100

It will be seen that in each case the maximum percentages of sand pass through the sieve between ¼ mm. and ⅛ mm., and between ⅛ mm. and ¼ mm. This indicates that the grain of maximum velocity is about ⅛ mm. in size. This agrees closely with the size called for by theory. The theoretical limit* of successful work on these jigs is therefore about ⅛ mm.

It would be possible to classify the sands before jigging and to send all this fine stuff directly to the tables. This would necessitate the use of a large volume of water to effect the classification and would involve a large increase in the number of slime-tables.

Experiments are now being made, with every prospect of success, to reduce the loss in this very fine material, without sacrificing the advantages of present method of treatment.

Spitzkasten.

The hutchwork of the roughing-jigs goes through a series of spitzkasten, respectively 1½ x 7½ feet, 4 x 6½ feet, 8 x 12 feet and 8 x 12 feet in horizontal cross-section and 2 feet, 7 feet and 10 feet deep. These boxes are built between the posts supporting the main floor of the mill. Their position is indicated in Plates I. and II.

Trunking-Machine.

The material settling in the first box goes to the trunking-machine. This machine consists of a semi-cylindrical iron trough in which revolves a screw conveyor. The trough is divided into two sections, respectively 14 feet and 10 feet in length. The screw conveyor in the lower and longer section is made up of fan-shaped blades of castiron, about 4¼ inches wide, with a space of about 2 inches between them, breaking the continuity of the screw. The material to be treated flows through rubber hose from the settling-box into this trough; being introduced about midway. The revolution of the shaft forces

the galena toward the upper end. The water flows out at the lower end of the trough, carrying with it all the light sand. Wash-water is admitted through a line of spigots at the side of the trough. The upper section of the trough simply serves to convey the galena into the car.

Mineral coarser than ¼ mm. or ⅛ mm. is very perfectly concentrated by this machine and delivered to the car as nearly pure galena. Mineral finer than ¼ mm. is carried off in the tails. The tailings from this machine are united with the product of the second box of the spitzkasten and go to the three-sieve finishing-jigs.

Finishing-jigs.

The three sieve Hartz jigs used as finishing-jigs, as well as for the treatment of the crushed raggings, are of the ordinary side-piston type, and are not figured. They do not require special description. They are run at a speed of 270 strokes per minute; strokes ¼ inch in length. The jigs treating crushed raggings are run slower, 210 strokes, ⅝ inch long, per minute. The jig-sieves are of No. 8 wire cloth (No. 17 wire).

The following table gives the results of typical assays on samples subdivided by sifting:

Size.	Per cent of sand of given size.	Lead in sands treated Per cent.	Lead in Hutchwork.			Lead in tailings. Per cent.
			1st sieve. Per cent.	2d sieve. Per cent.	3d sieve. Per cent.	
Above $\frac{1}{4}$ mm	8.9	40.99	} 79.69	} 70.34	} 41.80	3.94
$\frac{1}{8}$ mm. to $\frac{1}{4}$ mm . .	43.6	16.76				1.02
1-20 mm. to $\frac{1}{8}$ mm.	13.3	16.40				.62
Below 1-20 mm. . . .	34.2	32.58				11.97
Average	100.0	24.75	Average three sieves, 74.00			5.24

The material treated on the finishing-jigs is very rich containing about 25 per cent. of lead, and the losses are quite large. The material treated is also very fine, over 90 per cent. being less than $\frac{1}{4}$ mm. The losses are confined to the stuff below $\frac{1}{8}$ mm., above that limit the tailings are poor, with the exception of the stuff above $\frac{1}{4}$ mm., the quantity of which is small (about 3 per cent. of the tails). It will be seen that these jigs treat successfully finer stuff than the roughing-jigs, probably because of the finer jig-cloth and smaller interstitial channels. It is proposed to treat the tailings of these jigs, or at least the finer portions of the tails, on round or side bump tables.

Parsons-Rittinger Tables.

The Rittinger side-bump table, as modified by Mr. Parsons, is shown in detail on Plate V. The tables are built in pairs, and each table is made double as usual. They are small, each half the double table being about 3 feet by $7\frac{1}{2}$ feet. Instead of being hung from rods the table is supported on four cast-iron feet or "guides," which slide on horizontal steel rods. The latter rest in cast-iron "saddles, bolted to the heavy sill-timbers which run under the whole row of tables. Light spiral steel springs around two of these rods give motion to the table. The tables bump against each other, the blow being taken by a joist of hard wood lying loose between them (not shown in the drawing). The tables are forced apart, against the tension of the springs, by a spiral wedge-shaped cam; 150 bumps, $\frac{5}{8}$ inch long, are given per minute.

The surface of the table is covered with the black enameled duck, sometimes used for desks. This covering is cheap and easily renewed, and furnishes a surface well adapted for the exceedingly fine material treated. The tables are inclined $4\frac{1}{2}^\circ$. There are 16 pairs of double tables in the mill, or 64 table in all. Of these, 32 are head tables and 32 are used for treating middlings. They are not worked to their full capacity, the head tables treating but $1\frac{1}{4}$ tons each, or $2\frac{1}{2}$ tons to the double tables per twenty-four hours. The material treated is exceedingly fine, 70 per cent. being less than $\frac{1}{8}$ mm.

The following are typical assays of the stuff treated and the resulting tailings. The samples, as before, were subdivided by sifting.

Size.	Percentage of sand of given size.	Percentage of Lead in stuff treated.	Percentage of Lead in tailings.
$\frac{1}{8}$ mm. to $\frac{1}{4}$ mm.	9.0	2.50	.82
$\frac{1}{4}$ to $\frac{1}{2}$ mm. to $\frac{1}{8}$ mm.	19.4	2.65	.40
Below $\frac{1}{8}$ mm.	71.6	15.52	2.74
Average.	100.0	11.75	2.45

Loss in Dressing.

For the year ending May 1st, 1887, the yield of the ore treated was 5.65 per cent. The loss in the tailings is about 2.13 per cent., or 27.4 per cent. of the total amount of lead in the ore. The losses in the Lake Superior copper mills range from 28.5 per cent. to 31 per cent., treating material much more easily saved than this galena. The losses in each case are due to include mineral in the coarser sands, and to finely divided mineral in the very fine slimes. At Bonne Terre an unusually large part of the mineral exists in the ore in an exceedingly fine state of division, as is shown by the large percentage of included mineral in stuff as fine as $\frac{1}{8}$, $\frac{1}{4}$ and $\frac{1}{2}$ mm. This necessitates very fine crushing, and consequently involves the production of a large amount of very fine stuff, much of which contains galena too fine to be saved.

Cost of Dressing.

The cost of dressing for the fiscal year ending May 1st, 1887, was 36.4 cents per ton, divided as follows:—

Labor	13.4
Repairs	10.0
Supplies	3.5
Coal	9.5
	36.4

This compares favorably with the very best Lake Superior practice, the cost of dressing at the Atlantic mill for the last few years being per ton of rock:

	Cents.
1881	42.54
1882	37.07
1883	35.35
1884	38.95
1885	30.36
1886	26.5
1887	27.5

The cost at the Atlantic mill (for 1885) can be subdivided as follows:—

	Cents.
Labor	10.86
Fuel	14.52
Supplies, etc.	4.98
	30.36

At the Atlantic mill, the water is supplied through a launder above the level of the mill-floor and is not pumped. The ore also is delivered to the mill at a higher level than at St. Joseph and need not be elevated in the mill. This rock has also been previously crushed by jaw-crushers at the rock-house, the cost of which crushing properly belongs to the cost of dressing, but is not included in the published figures. Finally, the sands are carried off with the water in the waste launders and do not have to be loaded into cars. At least 10 cents per ton, therefore, should be added to the Atlantic mill figures in making comparisons of cost at the two places.

The amount of rock treated per ton of coal consumed is as follows:—

St. Joseph mill, 1887	33.59 tons.
Atlantic mill, 1886	28.34 tons.

The advantage in favor of the St. Joseph mills would be even more striking if an allowance were made for the fuel consumed in elevating water and ore.

The limestone crushed at St. Joseph is probably not as hard as the amygdaloid rock treated at the Atlantic mill. Somewhat finer screens are used at the Atlantic mill, but the average fineness of the ore is almost exactly the same.

	(1887). St. Joseph mill. (Rolls).	(1886). Atlantic mill. (Stamps).
Above 1 mm	43.0	41.6
$\frac{1}{4}$ to 1 mm	27.0	27.6
Below $\frac{1}{4}$ mm	30.0	30.8
	100.0	100.0

These figures indicate that it is cheaper to crush by rolls than by steam-stamps; and that the rolls produce quite as large a proportion of slimes as the stamps. The cheapness of the crushing and the large amount of slime, however, are both due in part to the friability of the ore.

It will be difficult to find two mills, either in this country or abroad, treating ore at equally low cost; and the above figures furnish a powerful argument for the English method of concentrating without size classification.

The losses in the treatment of the very fine stuff are large both at Lake Superior and in Missouri. The remedy in each case will doubtless be found in better methods of crushing and in extending and perfecting the slime-treatment.

*Trans. Am. Inst. of M. E.

* "Movement of Solid Bodies in Water," "Theory of Jigging," by the writer. See *School of Mines Quarterly*, vol. ix. Nos. 2 and 3.

* Loc cit.

Canadian Peat Fuel.

Peat occurs in great abundance in many places in the Dominion, but has never been much worked, except in a few localities south of the River St. Lawrence, more particularly at St. Hubert, in Chambly County, about ten miles from Montreal, and at St. Brigid, about ten miles from the town of St. John, on the Richelieu river. It is also known to exist in large deposits in New Brunswick, in other parts of Quebec, in Ontario, and in the North-West Territories. The utilization of peat for fuel has occupied the attention of economists and others for many years, but hitherto, none of the many schemes brought forward have been sufficiently practical and economical to bring it into general use. Mr. David Aikman, of Montreal, who has given much time and consideration to the subject has, however, produced a fuel from peat which is in many respect superior to coal. Its heat-producing power is as great as coal, and can be easily understood from the following analysis:—

Moisture	3.84
Fixed carbon and volatile matter	89.26
Ash	6.90
	100.

Analysis of Coal.

Moisture	4.59
Fixed carbon and volatile matter	89.49
Ash	5.92
	100.

It burns with a clear white flame, after all the volatile matter is consumed, leaving a bright red coal which will last for a long time.

Owing to its freedom from sulphur and its specific gravity being equal to coal, makes it invaluable for use on locomotives. Air-dried peat was used on the Grand Trunk railway. Taking one trip as an example on Engine No. 158, five feet driving wheels, sixteen inch cylinders, and twenty-six-inch stroke, drawing twelve loaded cars:—

Distance run per ton of 2,240 lbs.	
of fuel	40.33 miles.
Fuel used per mile	55.44 lbs.
Greatest pressure of steam	140 "
Least "	100 "

During the experiment fuel was put on in small quantities; no smoke issued from the stack; a steady brilliant white fire was kept up and steam generated with great rapidity. The damper was kept closed, and air admitted through a slot in the furnace door. Not an atom of ash or cinder was left in the smoke box, ash pan or upon the wire gauge or spark catcher. The bottom of fire box was scarcely ever covered with the fuel, the steam being generated too rapidly to allow of a large quantity of fuel being put into the furnace. For all kinds of steam boilers it can be used to advantage, also for smelting purposes, as it stands a very strong blast. It is also the cleanest and most economical fuel which can be used in grates and stoves, for heating and cooking.

The fuel is made by machinery carried on a scow which is made to float in the bog, the peat is excavated by a pair of large screw augers which work in front of the bow and deposit it in a well where it is submitted to the action of steam taken from the exhaust of the engine, it is then brought by an elevator to the squeezer, where it is deprived of about 33 per cent. of water, after which it is broken by revolving teeth, passed through a dryer of a special construction invented for the purpose and delivered into the press in the form of dry dust, which by the action of heat and the screw is brought into a pasty condition, the tar or resin naturally contained in the peat being set free, under the pressure it becomes partially carbonized and issues from the press in a continuous stick of peat fuel ready for use, it may be two, three, four or more inches in diameter. The whole process is entirely automatic, and only takes about twenty minutes from the time of excavation from the bog to the time it is delivered from the press. We will suppose the scow as described with excavator, and peat-making machinery, all ready to start, and the line on which she is to work decided upon. It will be necessary to clear away in front of her a space, the width she is intended to cut, (it may be 14, 16, or 20 feet), if the bog is soft this can be done by men on a gangway made on purpose so as to move along without sinking, the fibre moss, etc., lying on the surface must be cleared off, this can be laid on one side to form a pathway, which will become solid as soon as the drainage operation begins. The machine can then move forward in the usual way, and will cut about 3,000 feet in a week, converting the peat excavated into good solid fuel, available for any purpose for which coal is used at the rate of about 550 tons for the 3,000 feet advanced, if the cut is 20 feet wide and leaving behind a canal full of water which must be kept up to its level, in order to allow the machine to continue her operations. When the water ways are all made, discharges can be cut to allow the water to drain away which it will do very quickly, smaller cross drains can then be cut cross-ways as the bog gets more solid. In a short time, it will easily be seen, that by this system bogs or marshes which are now almost inaccessible and waste, can be converted into solid ground available for agricultural purposes. In this country where our peat operations have been carried on, the surrounding lands which were so wet that nothing could be done with them have been all reclaimed and are now cultivated and bearing crops. The entire cost of one machine with complete outfit for drainage and peat making purposes in Canada is about \$9,000. If it was only intended for drainage purposes the cost would be about \$4,000. The material excavated could then be deposited as a road bed alongside of the canal and be made available for transport etc.

The special advantages claimed for this fuel are:—

- (1) That it can be produced at a less cost than coal, and that a great saving can be made in transportation, because it is more uniformly diffused over all the country compared with coal.
- (2) That it is more economical.
- (3) That it is free from sulphur.
- (4) That it does not make clinkers.
- (5) That it lengthens the life of fire-boxes, grate-bars, fire-bricks, grates, stoves, etc.
- (6) Saving a cost of repainting railway coaches through absence of cinder sparks, etc., comfort of passengers.
- (7) That it is superior for making iron and steel.

We understand that a company is now being organized in Canada and that the work of utilizing peat lands for fuel will shortly be an accomplished fact.



MINING NOTES.



Nova Scotia.

(From Press Committee Gold Miners' Association.)

Beaver Dam.

Reports from this district are to the effect that Mr. D. S. Turnbull is pushing the construction of the twenty-stamp mill as fast as possible, in the hope of starting it before cold weather comes.

Chester Basin.

Since the closing down of the Neptune Co.'s mine in the Spring little or nothing has been done in this district. A few prospectors are at work, but no pay lode has as yet been found.

Gay's River District.

The Coldstream Mining Co. are at last beginning to work. The excavations for the proposed fifty-stamp mill have been begun, and a large boarding-house is in course of erection. Work on the mining property proper, however, is yet in its inception, and the company has not yet got down to real development work. It is expected, however, to increase the working force of miners this month.

Renfrew District.

The "Free Claim" property here has resumed active mining work. During the summer the owners have rebuilt the ten-stamp mill, putting in new foundations and mortar, and entirely rebuilding the water-wheel.

The Empress Co. are rebuilding the engine-house and shaft-house recently destroyed by fire, and the new machinery for pumping out the old Ophir lode has been completed and started up. The owner, Mr. C. H. North, of Boston, paid the property a visit last week.

South Uniacke District.

A representative of the Thomson-Houston Electric Co. has recently contracted with Messrs. Thompson & Quirk to supply their mine in this district with one of the company's new electric percussion drills. The agent, Mr. Medbury, proposes to set up the drill in Halifax and operate it for a week or so, in order that mining men may have an opportunity to see the drill at work and judge of its merits.

This will be the first installation of an electric drill in Nova Scotia, and will, in fact, be the first drill put upon the market by the Thomson-Houston people. The results will be carefully watched by our gold mining men, and a detailed account of the drill and its success or non-success will appear in the REVIEW.

Stormont District.

In the matter of the Palgrave Mining Co. *vs.* J. McMillan *et al.*, a hearing was given before the Commissioner of Public Works and Mines on the 11th inst., at Halifax, on the petition of the Palgrave Co. that it be allowed entrance on lands claimed by McMillan and others for the purpose of working its mineral property, under sec. 44 of the Revised Statutes. No decision has yet been given by the Commissioner.

It is greatly to be desired that some new legislation be introduced at the coming session of the House of Assembly which shall have for its object the settlement of one of the evils of the existing laws, viz., the uncertain relation existing between the owner or claimant of the land and the lessee of the mineral rights. To this uncertain relation are traceable the source of much litigation whenever the mineral rights prove to be of value.

Gold Mining Supplies.

The principal depot in Nova Scotia, carrying the most complete assortment of first class goods, is

H. H. FULLER & CO'S

41 to 45 Upper Water St., Halifax, N.S.

Our line comprises Explosives, Fuse, American and English Mill and Hammer Steel, Bar and Bolt Iron, Steel Wire Hoisting Rope, Hemp and Manilla Rope, Rubber and Leather Belting, Miners' Candles, Oils and Lamps, Miners' Tools, Machinists' Tools, Blacksmiths' Tools, and every requisite for the gold miner.

H. H. FULLER & CO.,
Halifax, N.S.

Waverley District.

Up to the 16th instant the fine new mill of the Lake View Co., at this place, which was to have been completed the 1st. of August, and then the 1st. of September had not dropped a stamp. It is now announced that the mill will not be running before October 1st. The mine is yet idle.

Tangier District.

The property of the Brunswick Gold Mining Co., at this place, was sold on September 13th by the Sheriff at public sale and was bid in by Mr. Parker, solicitor, for the sum of \$8,500. It is rumored that Mr. Parker bought for New York parties who intend re-opening the property.

Montague District.

There is little that is new to report from this district; work has been rather slack, and the working mines have apparently come into a temporary lean streak. Rumors of a sale in the district for a large figure cannot be traced to a reliable source.

(From Our Own Correspondent.)

Cumberland County.

The sale of the Joggins coal mine is stated to be definitely closed, the price named being \$230,000. It is reported that the purchasers are interested in the Canadian Pacific Railway.

The Boston Coal Mining Company having neglected to pay the annual rental, its leases have been declared forfeited. The property had not been worked for some time.

Cape Breton.

The Sydney and Louisburg Coal and Railway Company is stated to have found the Carrol seam underlying several square miles of its territory. Further details as to its size, quality, etc., are not yet available.

The Mullins seam of North Sydney is reported as yielding five feet six inches of good coal, and already extensive rights have been secured along its line of outcrop.

Pictou County.

Mr. John Douglas, who has been coal prospecting for the Black Diamond Company, has suspended operations, believing that nothing of any value can be found in that section. Prospecting by other parties at a point four miles north-east of where Mr. Douglas was at work have also proved unsatisfactory.

Messrs. John Muir & Sons have had a siding constructed into their workings, which will connect them with the Vale railway and give them a more profitable outlet for their coal than heretofore.

The re-opening of the Food pit continues satisfactorily.

Twenty new coke ovens have been added to the plant of the Drummond colliery. These are understood to be giving good satisfaction, but no reliable figures of the quantity manufactured have yet been made public.

In General.

The next regular monthly meeting of the Gold Miners' Association will be held at the Halifax hotel on Friday, 3rd October next, at two o'clock in the afternoon. A full attendance is particularly requested.

Mr. Joseph R. Wilson, son-in-law to Mr. Thomas Shaw, M.E., inventor of the Shaw Mine Signalling apparatus, has been giving an exhibition of his machine in Halifax, at Stellarton, and other points in the coal district. The owners of the patent on this new machine are evidently leaving no stone unturned to create a sentiment in favor of its adoption. The *Colliery Engineer* and several of its readers are protesting against its introduction in the collieries of Pennsylvania, claiming that it is impracticable. We should, however, be glad to have the views of some of our colliery engineers on its merits.

According to the official returns there has been a decline in the importation of American coal into Canada during the twelve months ending 30th June last, as compared with the corresponding period ending 30th June, 1889. The figures stand 1,372,225 tons, value \$5,366,643 for 1889, and 1,305,671 tons, value \$4,768,549 for 1890. According to these figures the average price was \$3.91 in 1889, and \$3.65 in 1890.

Reflecting the views of the Dominion Government on the question of reciprocity in coal, the London *Free Press*, the special organ of the Minister of Agriculture, says:—"Every pound of hard coal that we use is admittedly free of duty, but we will wait in vain for the United States to offer the freedom of 'the markets of

sixty millions' to the soft coal yielded from our mines. As they have built a wall against our great Nova Scotia industry, in the interest of Pennsylvania, it is but natural that similar protection should be afforded to our own people, hence the Canada duty of sixty cents per ton against the United States duty of seventy-five cents, and with that arrangement all parties in this country are very well content. Nova Scotia is selling more coal in Quebec than she ever sold before, not even excepting the year when the United States took our coal free of duty, and in return they take from the upper provinces the stores of provisions which formerly came from New England. The coal duties are not so oppressive to Canadians, but the duty levied by the United States is a serious burden on their own people, especially to the shipping of both the Atlantic and Pacific. Every pound of coal used by the steamships of San Francisco is brought from the mines of British Columbia. It would be a great relief, therefore, to abolish the duty there, but if they choose to tax themselves in that quarter, it is but little spite to the British Columbia miners."

The Halifax Mining and Prospecting Company is the name of another new company which was been granted a charter on the 16th inst. Directors—Charles Annand, Halifax, N.S.; Geo. E. Forsythe, Halifax, N.S.; B. F. Pearson, Halifax, N.S. Capital, \$250,000. The chief place of business will be at Halifax.

Application for incorporation is made by "The Napier Mining Company, Limited." Capital, \$120,000, divided into 1,200 shares of a value of \$100 each. Directors—W. J. Fraser, Halifax; Frederick Taylor, Lowell, Mass.; John E. Hardman, Oldham, N.S. The chief place of business of the new company will be at Oldham.

Quebec.

A large force is at work at the Temiscamingue mines. The shaft has been put down to a depth of 75 feet and is still in first-class galena ore.

Templeton District.

The Blackburn, McLaurin, and other phosphate mines in this district are working steadily and a good force is employed at each.

The asbestos property, owned by American capitalists, is also being developed. A force of 19 men was put on last month, and at last reports the veins had widened to four inches and were yielding in good quantity. Asbestos of good quality has been mined.

Ottawa Valley.

Mr. E. Packard, Chairman, and Mr. C. C. Hoyer, Millar, visited the mines of the Canadian Phosphate Company during the month and report themselves much pleased with the result of the operations at the pits. The production for the month has been larger than for any previous period since mining was begun by the company. The Directors have declared an interim dividend of 6d. per share, payable on 1st November.

The representatives of the Phosphate Corporation (Limited) are now on a tour of the phosphate mines in this district. We are informed that the properties so far acquired consist of the Ross Mountain Lot, from the Hon. J. C. Abbott, the Murphy Lot in Templeton, and the Stewart Lots near the High Falls, Lievres River, in all about 2,000 acres. Mr. J. Lainson Wills and Mr. George Attwood, M.E., are acting for the company. Mr. Knud Sando, one of the principal promoters, and Sir George Baden Powell, one of the directors, arrived in Buckingham on 30th inst. on a visit to some of the properties now before the company for purchase. They both condemn the high prices asked by vendors.

Eastern Townships District.

Dr. James Reed has placed an order with the Ingersoll Rock Drill Company for a plant similar to that put in at the American Asbestos Co., the United and King Bros. mines. Lots 27, 28, 29, in Range A Coleraine, are to be worked extensively. These lots give good promise of becoming large producers of asbestos.

All the mines at Thetford and Black Lake continue working steadily, and managers are pleased with their outputs. The production of asbestos for this season will show a decided lead over any previous years' operations.

The American Asbestos Company are putting in a cable derrick to carry off their waste rock from working ground.

The Anglo-Canadian Co.'s output still continues to lead the other Black Lake mines, and at the end of the year will be found to be nearly double the company's production for the same period last year.

The United Asbestos Company's turnout for last month was extremely satisfactory, a goodly portion of the output being No. 1.

Messrs. King Bros. are opening out their Black Lake Lots under direction of Mr. A. M. Evans.

The Excelsior Copper Company are testing undeveloped portions of their Harvey Hill property with the Diamond Drill.

Ontario.

The Provincial Natural Gas and Oil Company are busy laying their pipe line from the wells at Welland to Buffalo, where the line will be assumed by the Standard Oil Company.

A small force of men is employed opening up a promising deposit of iron ore on the Desbarats location, 35 miles east of Sault Ste. Marie on the line of the C. P. R.

The Sebastopol Phosphate Syndicate, Limited has been registered in London, September 1st, 1890, by Leslie, Antill and Arnold, 1, Gresham-buildings, E.C., to acquire any phosphate or other mines, and to work and develop the same. Capital, £5,000, in shares of £1 each. First Subscribers—G. J. Wells, of Chester; G. C. Lomer, 4, Fenchurch avenue, E.C.; and five others, each taking one share. This is a new company to be under control of Messrs. Lomer, Rohr & Company, Montreal, and to operate a phosphate property at Sebastopol.

Perth District.

The Anglo-Canadian Phosphate Co. continue their system of day work at the Otty Lake mines, near Perth, Ont., under charge of Mr. Robert Cordick, and during the summer have opened up over thirty of the old contractor's pits besides discovering several new shows. A force of about twenty-men is employed and 250 tons of high grade phosphate is now ready for shipment, besides a quantity of seventy per cent. ore. The phosphate has been sold for shipment to London.

Work has been resumed at the Bob's Lakes mines, Bedford, Ont., by the Anglo-Canadian Phosphate Co. This property has been worked for the past two years under the contract system, but will now be operated by day labor. Over one hundred seams of phosphate have been opened up by the contractors on a small portion of the property, a good deal of which remains to be explored.

Port Arthur District.

(From Our Own Correspondent.)

THE BADGER SILVER MINING COMPANY.—This company shipped a car load of high grade smelting ore, valued at \$15,000, to Geo. W. Robinson, 91 Wall street, New York, on the 10th inst. This ore has all been taken from No. 4 vein, (Porcupine) since Aug. 4th, together with about 350 tons of milling ore. They have another car load of high grade ore about ready, taken from No. 2 vein, within the same period, which will be shipped about the 15th inst. No. 1 Adit level is still in bonanza ground both ways, which taken with the body of ore at the bottom of the shaft, makes a certainty of No. 4 vein being a great producer. The mill is kept in full blast night and day, breaking 35 tons of ore daily. The Badger is going to exceed the highest expectations formed of it at the beginning of the season. Supt. Shear estimated that he would be able to ship a car load of high grade ore monthly, and he will have two car loads to his credit for September.

THE BEAVER MINING AND MILLING CO.—This company shipped a car load of high grade ore and concentrates, valued at \$17,000, to Messrs. Balbach & Son, Newark, N.J., on the 10th inst. They have another car load ready for shipment, but teams have been scarce lately, that they have been unable to have it transported to Murillo. The Beaver looks remarkably well, all the slopes being in high grade ore. The production is averaging over \$40,000 per month. A new vein carrying good milling ore at the surface has been opened on the North Bluff; Capt. Hooper has a gang of miners employed opening it out. It is improving in richness as development proceeds and gives promise of being a good producer.

THE KING.—This property is composed of the north half of lot No. 12, in third concession of the township of Strange, and comprises 320 acres. There are six parallel veins on the property, only one of which has been partially developed. This vein was two feet wide at the surface; at a depth of eight feet it had widened out to four feet, from which point it has maintained a uniform width to the bottom of the shaft, which is now down 26 feet. The pay streak is 18 inches wide. At a depth of

eight feet the vein gave assays from 40 to 3,000 ounces of silver to the ton of 2,000 pounds. No assays have been made below that point, but the vein has become richer and more heavily mineralized, and on assay will, no doubt, carry much higher in silver than near the surface. The Whitefish river runs along the south boundary of the property and has a fall of 125 feet in passing from the west to the eastern limits of the property, which will furnish ample power for all necessary works in treating the ore. The Port Arthur, Duluth and Western Railway runs within two miles of this property, and when it is completed to that point, which will be about November next, the first shipment of higher grade ore will be made and all necessary machinery taken in to operate the mine. The owner, Mr. Bonfield, of Petrolea, Ont., intends to thoroughly explore and develop all the veins on the property.

THE BLACK RIVER AND TERRACE BAY GOLD MINING CO.—Capt. Andrews and W. Roland, M.E., have just completed tests and examinations of the different mineral lodes on this property and all arrangements for future operations are now about completed. The results of the tests made and the exploratory work done, show that these veins carry from \$9.50 to \$17.50 per ton in gold, and from three to thirteen ounces of silver to the ton of 2,000 pounds. While concentration tests made at the Beaver Mining and Milling Company's mill by C. Romer, Ch., go as high as \$500 per ton. Over twenty new veins were discovered on the property during the course of the exploratory work by Capt. Andrews and Mr. Roland. The property consists of four locations of 400 acres each. It is well timbered and has a magnificent water power at the Bridal Veil Falls on the Black River which runs through the property. It is easily accessible by the Canadian Pacific Railway or by steamer from Lake Superior.

THE STAR MINE.—Drifting is being proceeded with from the bottom of No. 2 shaft, the vein is holding out in width and richness. As soon as machinery can be transported in over the Port Arthur, Duluth and Western Railway, operations will be carried on, on a more extensive scale.

THE OGEMA.—Professor Hillé, M.E., has made an examination of this property which is situated in the township of Dorion, in the Black Bay district. A high range of granite bluffs traverse the property, the vein occurs about half way up the bluff, along the contact of the granite and gneiss, which forms the valley below. The outcropping is about eighteen inches in width, nearly solid galena, twenty feet below an adit has been run in to cut the vein, here it is double the width that it was at the surface, and the galena assays from 62 to 64 per cent. Assays from samples taken at the surface, showed it to carry 24 ounces of silver to the ton of 2,000 pounds.

Manitoba and N. W. T.

The track of the Galt railroad is now laid to a point 30 miles north of the boundary line. It will probably be completed to Lethbridge by the 20th inst., and be formally opened to the public by an excursion from that place to Great Falls on or about October 1st.

A special general meeting of the Alherta Railway and Coal Company will be held at their offices 37 Old Jury, London, Eng., on 15th October. The purposes of the meeting are:

1. To authorize the purchase and to accept the transfer of the property and assets of the North Western Coal and Navigation Company (Limited);
2. To authorize the issue of mortgage bonds and share capital both preferred and ordinary required for the purposes of the company;
3. And generally to consider and adopt all measures incident to or arising out of the agreements with the North Western Coal and Navigation Company, Limited, with the Great Falls and Canada Railway Company and with the Lethbridge Construction Company;
4. To approve the head office of the company in London;
5. To receive the report of the directors and pass the accounts of the company, and to fix the remuneration of the directors.

The average monthly output from the Lethbridge collieries since 1st January, 1890, has been 11,000 tons. 650 men and boys are employed.

The Canada North-West Coal and Lumber Syndicate are raising about 100 tons of coal per day. A force of 75 men and boys employed.

Sir Alexander Galt, who has been upon a tour of inspection of his railways and coal interests in the Northwest has returned East. At Great Falls, Montana, connection is made with the new railway connecting the Great Northern road of Montana with the Galt coal

mines at Lethbridge. This road is 198 miles long, of which 150 miles are completed. Over this distance Sir Alexander and party travelled on an engine, reaching the spot to which the track had been completed ten miles this side of the boundary. This new connection will prove of mutual benefit to the people of Montana and the Galt mines, giving the former their coal at much cheaper rates than is now possible and the latter an enlarged market for its merchandise. The mines are now producing about 11,000 tons per month, but this will be materially increased shortly. Three new shafts have been recently sunk, two of which are now yielding coal, and the third is expected to be worked very shortly. The extension of these mines has built up Lethbridge in a wonderful manner.

A demand of assignment has been made by Mr. James Baylis, merchant, of Montreal, a creditor to the extent of \$3,794 dols., on The Stair Coal Mine and Manufacturing Company, Limited. The petition for a winding-up order was granted by Justice Wurtele, sitting in the Superior Court, and Mr. George H. Paterson, accountant, was appointed provisional liquidator. The exact liabilities of the company have not yet been filed but are supposed to be heavy.

British Columbia.

The captain of the steamer Empire, which recently arrived at San Francisco from Nanaimo, B. C., reports that there is no change in the condition of affairs at the mines. The miners still hold out, and the Dunsmuirs will not give in. The steamer Wellington is tied up at the wharf and the crew has been discharged. On her last trip from this port the Wellington took up thirty men who had been engaged to work in the mine. When they arrived at Nanaimo all the men joined the strikers, save three. There are sixteen men at work in the mine, and these can just turn out enough coal to supply the Vancouver tugboats. When the strike took place, over 400 men walked out. Of this number about 150 were single men. The latter have left the island and obtained work in Vancouver, Seattle and Tacoma. The married men are supported by contributions from the other miners. All the men employed in the mines belong to the Union, and every man who is at work is assessed 10 per cent. of his wages. The troops sent from Victoria and Vancouver, to quell any riot that might arise, are to be sent home. There is no chance of a settlement, and it will be several months before any Wellington coal arrives in San Francisco.

Six striking miners, on trial on a charge of intimidating miners working at the Wellington collieries, have been found guilty. The Chief Justice bound each of them in \$200 to appear for sentence when called, remarking that the full effect of their act was probably not yet developed. In rendering judgment he said: "I suppose you never think, read or write, or if you do you get newspapers edited by men just as ignorant as yourselves, who only write what they know you will buy." The strike is still unsettled.

Cariboo District.

The Black Jack—a one stamp mill—started last year, with satisfactory results, is still pounding away, and the company hopes to increase its capacity in due time.

The Golden Mining and Smelting Co. have almost completed their works and will be shortly ready for ore; in fact, they are now making advances on all ore shipped them.

The Forks of Quesnelle, is enjoying something of a boom in the way of alluvial mining. Various new locations have been recorded within a few weeks, and strong companies organized to work them. The gold taken out is coarse, and the prospects are remarkably good; but it will take a considerable expenditure of capital to realize them.

The Island Mountain Company's quartz mill has now been running steadily for two or three weeks, and the results, so far as the public know them, are encouraging. The starting of this mill has been awaited with eager expectation and hopefulness, for it was felt that if it proved a success the erection of other mills and the development of our numerous quartz ledges would follow as a matter of course. Our hopes seem, therefore, on the point of realization. The mill is a ten stamp one, and has four of the best modern concentrators.

West Kootenai Minerals at Toronto.

West Kootenai sent an excellent display of mineral specimens to the Toronto Exhibition. The utility and value of this exhibit was, however, sadly diminished by the wretched accommodation provided for it by the Exhibition people, the whole being crowded into a dirty little shanty in which British Columbia potatoes, fruits,

mountain goats and other products were piled in a most indiscriminate and unattractive manner. This is a matter which we commend to the attention of the authorities, who should be well able to provide first-class accommodation for exhibits of so much importance to the development of the country.

The following is a detailed description of the 43 samples of ore on exhibition:—

TOAD MOUNTAIN.

1. Grizzly, R. & A. C. Fry, 75 oz. silver, vein 6 feet, Toad Mountain, 60 feet of shaft sunk, 8 miles from Nelson.

2. Cariboo, A. C. Fry, 175 oz. silver, vein 4 feet Toad Mountain, 2 shafts sunk, 10 and 15 feet, 8 miles from Nelson.

3. Dandy, Fox, Kelly & Cook, 50 oz. silver, vein 7½ feet, Toad Mountain, 65 feet of tunnel on ledge, 8 miles from Nelson.

4. Iroquois, C. M. Townson & Co., 40 oz. silver, vein 13 feet, Toad Mountain, 2 tunnels 70 and 50 feet on ledge, 8 miles from Nelson.

5. Tough Nut, Dr. Hendryx, 45 oz. silver, vein 4 feet, Toad Mountain, 37 feet of shaft, 102 feet tunnel, 8 miles from Nelson.

6. Silver King, Hall Bros., \$300 silver, vein 15 feet, Toad Mountain, 160 feet of shaft, 200 feet of tunnel, 8 miles from Nelson.

HOT SPRINGS.

7. United, Revelstoke Mining Co., 24 oz. silver, 50 per cent. lead, vein 5 feet, Hot Springs, ledge stripped 150 feet; 2 miles from Ainsworth.

8. No. 1. Revelstoke Mining Co., 89 to 249 oz. silver, vein 8 feet, Hot Springs, 430 feet of tunnel, 3 incline shafts, ore houses, etc., 2 miles from Ainsworth.

9. Spokane, L. C. Dilman & Co., \$35 silver, vein 4 feet, Hot Springs, 40 feet of incline shaft, ¾ mile from Ainsworth.

10. Sky Line, A. D. Wheeler, \$400 to \$16000 silver, vein 15 feet, Hot Springs, 130 feet of shaft on ledge, 3 miles from Ainsworth.

11. Pearl, B. B. Barker, 40 oz. silver, vein 1½ feet, Hot Springs, 14 feet of tunnel, 3 miles from Ainsworth.

12. Little Phil, Thos. McGovern, \$10 to \$200 silver, 4 ft. Hot Springs, several crosscuts on ledge, ½ mile from Ainsworth.

13. Tariff, George Francis, \$27 to \$34 silver, vein 6 feet, Hot Springs, several crosscuts on ledge, 1-2 mile from Ainsworth.

14. Kismet, H. Auderson, 25 to 40 oz. silver, vein 10 feet, Hot Springs, 30 feet of shafts, 3 miles from Ainsworth.

15. Let Her go Gallagher, A. D. Wheeler, \$460 silver, vein 8 feet, Hot Springs, 90 feet of shaft, ore houses, etc., 3 miles from Ainsworth.

16. Sunlight, Geo Herb, \$40 to \$175 silver, vein 8 feet, Hot Springs, 30 feet of shaft, cross-cuts, etc., 2 miles from Ainsworth.

17. Norman, McLeod & van Hook 40 oz. silver, vein 6 feet, Hot Springs 8 feet of shaft, 2½ miles from Ainsworth.

18. Arkansaw, Roberts & Buckley, 75 oz. silver, vein 8 feet, Hot Springs, 12 feet of shaft showing large body of ore, 2½ miles from Ainsworth.

19. Neosha, R. McLeod, \$500 silver, vein 6 feet, Hot Springs, 10 feet of shaft, 2½ miles from Ainsworth.

20. Union, Chas. Roster, 60 oz. silver, vein 5 feet, Hot Springs, 75 feet of shaft, ore houses etc., 2½ miles from Ainsworth.

21. Little Donald, E. L. Davenport, 75 oz. silver, vein 7 feet, Hot Springs, 130 feet of shaft, several crosscuts, 1 1-2 miles from Ainsworth.

22. Krao, A. D. Wheeler \$90 to \$384 silver, vein 12 feet, Hot Springs, 130 feet shaft, several crosscuts, 1½ miles from Ainsworth.

SUNDRY LOCATIONS.

23. Centre Star, Joseph Bourgeois, \$8 silver, \$48 gold, vein 20 feet, Trail Creek, 12 feet of shaft showing 20 feet of ore, 6 miles from Columbia river.

24. Josie, H. Sharon, \$8 silver, \$48 gold, vein 30, Trail Creek, ledge stripped showing large body of ore, 6 miles from Columbia river.

25. Queen Victoria, James Burr, 13 oz. silver, large deposit, Kootenay river, small test holes on hill, 6 miles from Nelson.

26. Royal Canadian, Simon Ray, \$76 to \$704 gold, vein 2 feet, Eagle creek, 2 tunnels 40 feet and 60 feet, 7 miles from Nelson.

27. Umatilla, F. C. Collins, 40 oz. silver, vein 5 feet, Nelson, shaft showing large body of ore, 7 miles from Nelson.

28. Poorman, E. L. Davenport, \$100 to \$200 gold, vein 2 1-2 feet, Egale Creek, 80 feet of shaft, 400 feet of crosscut, 6 miles from Nelson.

ILLECILLEWAET.

29. Maple, Cariboo Ck Mining Co., 45 oz. silver, 72 per cent. lead, vein 8 feet, Illecillewaet, 120 feet of tunnel 89 feet of shaft, 3 miles from C.P.R.

30. Maple Leaf, A. F. McKinnon, 80 to 90 oz. silver, 72 per cent. lead, vein 29 feet, Illecillewaet. Improvements \$3,000, 3 miles from the C.P.R.

31. Blue Bell, Green & Gallop, 65 oz. silver, 60 per cent. lead, vein 2½ feet. Illecillewaet, 45 feet of shaft, etc., 2 miles from the C.P.R.

32. North Star, Green & Gallop, 62 to 125 oz. silver, 70 per cent. lead, vein 6 feet, Illecillewaet, 20 feet of shaft, etc., 6 miles from C.P.R.

33. Jumbo, Corbin and Kennedy, \$100 to \$800 silver, vein 6 feet, Illecillewaet, considerable improvements done, 4 miles from C.P.R.

34. Goat Cave, A. Chisholm, 30 oz. silver, vein 2½ feet, improvements done to the value of \$400, 2 miles from C.P.R.

35. Dunvegan, Boyd, Bain & Co., 80 to 130 oz. silver, 78 per cent. lead, veins 8 feet, Illecillewaet, 500 feet of tunnel, etc., 11 miles from C.P.R.

36. Sultan, Boyd, Bain & Co., 200 oz. silver, 60 per cent. lead, vein 4 feet, Illecillewaet, improvements done to the value of \$500, 4 miles from C.P.R.

37. Gold Queen, Stark & Taylor, 18 to 200 oz. silver, 45 per cent. lead, \$9 gold, vein 4 feet, Illecillewaet, improvements to value of \$250, 5 miles from C.P.R.

38. Sanguhar, Walter Scott, 110 oz. silver, 22 per cent. lead, vein 24 feet, Illecillewaet, improvements to value of \$200, 14 miles from C.P.R.

39. Round Hill, Capt. McCallum, 18 to 42 oz. silver, 70 per cent. lead, vein 5 feet, Illecillewaet, improvements to value of \$500.

40. Gladstone, Kennedy and McCarthy, 70 to 1,100 oz. silver, 70 per cent. lead, vein 10 feet, Illecillewaet, improvements to value of \$5,000, 3 miles from C.P.R.

41. Crystal, Corbin & Kennedy, 100 oz. silver, 70 per cent. lead, vein 6 feet, Illecillewaet, 20 feet of tunnel has been driven, 3 miles from C.P.R.

42. Bobbie, A. Chisholm, 110 oz. silver, 70 per cent. lead, vein 14 feet, Illecillewaet, improvements done to the value of \$100, 3 miles from C.P.R.

43. Snow Flake, Jowett & Haigh, \$300 to \$1,500 silver, vein 2 feet, Illecillewaet. Improvements done to the value of \$1,000, 3 miles from C.P.R.

Portland Cement for Machinery Bolts.—The Troy, N.Y., *Polytechnic* gives the following results of an experiment with English Portland cement for testing its adhesive strength in pounds per square inch, compared with sulphur and lead, for machinery bolts in rock. In a solid limestone ledge 7 holes were drilled 1½ inches in diameter, and 7 of 1½ inches in diameter, 3½ feet deep. Seven ¾ inch and 7 1-inch bolts were prepared with thread and nut on one end, plain at the other, but ragged 3½ feet from the blank end. The following are the results of the tests: In sulphur, 3 out of 4 bolts developed full strength, 16,000 and 31,000 pounds; 1 1-inch bolt drew out under 12,000 pounds; in lead, 3 out of 4 developed full strength as above; 1 1-inch bolt drew out under 13,000 pounds; in cement, 5 out of 6 broke without pulling out; 1 1-inch bolt began to yield at 26,000 pounds, but sustained the load some seconds before it broke. Further tests showed the strength of the cement to be equal to 400 to 500 pounds per square inch of exposed surface. It seems to be ascertained that cement preserves iron from corrosion.

Profit Sharing by a Coal Company.—Three years ago the Campbell's Creek Coal Company, in the Kana-wha Valley, commenced the sharing of profits with its men, and on the first occasion divided something over \$6,000. Last year the amount was much less, because the profits were smaller. The result this year is shown in the announcement that on September 20th the company will divide \$4,500 among the men. The money is given out in proportion to the amount of wages the men earn, and the next distribution will give each man an average of about \$60. Besides sharing the profits the company does a sort of insurance business among the miners in a novel and commendable manner. In that district the miner is "docked," or forfeits a certain amount of his wages when the coal he turns out has over a fixed percentage of slate. The company mentioned takes the dockage according to the general custom, but that amount, instead of going to the company, is put into a fund for the benefit of the men. From this fund the men are entitled to draw \$4 per week when sick. On several occasions, when through numerous demands this fund has become exhausted, the firm replenished it temporarily. In another way this company and its employes have moved together for the common good. In that locality the public schools are open only about four months in the year. To continue the schools for nine months each year the miners pay each twenty cents per month into a private school fund. The effect of this plan of sharing profits, and the mutual good feeling between the men and their employers, is plainly apparent. The men are contented and steady; they have improved morally and physically.—*American Manufacture.*

Phosphate Shipments.

The following have been the shipments of phosphate from the Port of Montreal, as per Custom House manifests, to date:—

Date.	Name of Ship.	Destination.	Shippers.	Quantity.
Aug. 25	SS Lake Winnipeg.	Liverpool	Millar & Co.	250
" 28	Michigan	Hull	do	200
" 30	City of Lincoln	London	Lomer, Rohr & Co.	90
" 30	do	do	Millar & Co.	300
" 30	do	do	Wilson & Green	160
" 30	Barque Bianca	Newcastle	Millar & Co.	200
" 30	SS Oxenholme	Liverpool	Wilson & Green	415
Sept. 2	Lake Superior	do	Millar & Co.	150
" 3	Dominion	do	Lomer, Rohr & Co.	160
" 6	Cassius	Hamburg	Millar & Co.	240
" 6	do	do	Lomer, Rohr & Co.	120
" 9	Strs. Magln	Liverpool	do	185
" 11	Amarnthia	Glasgow	do	185
" 11	do	do	do (bags)	20
" 11	do	Liverpool	do	185
" 18	Barque Medor	U.K. Port	do	75
" 20	SS Gleniffer	Liverpool	Wilson & Green	150
" 20	do	do	Lomer, Rohr & Co.	150
				3215 tons
				20 bags.

SHIPPER'S RECAPITULATION.

	Tons.	Bags.		Tons.	Bags.
Lomer, Rohr & Co., (to 19th June)	2,715	100			
do (to 23rd July)	1,830	100			
do (to 23rd Aug.)	1,845	..			
do (to 20th Sept.)	1,350	20			
Millar & Co. (to 18th June)	1,475				
do (to 15th July)	1,540				
do (to 23rd Aug.)	300				
do (to 6th Sept.)	1,140				
Wilson & Green, (to 16th June)	823				
do (to 22nd July)	2,132				
do (to 23rd Aug.)	559				
do (to 20th Sept.)	725				
				4,455	
				16,434	220

RECAPITULATION OF EXPORTS.

	Tons.	Bags.		Tons.	Bags.
Liverpool—Previously reported	7,075	100			
do Reported to 25th Sept.	1,645				
Reported to date					
London—Previously reported	2,990				
do Reported to 20th Sept.	550				
Reported to date					
Hamburg—Previously reported	1,554				
do Reported to 20th Sept.	360				
Reported to date					
Glasgow—Previously reported	1,170	100			
do Reported to 20th Sept.	185	20			
Reported to date					
Swansea—Reported to date					
Hull—Previously reported	300				
do Reported to 20th Sept.	200				
Reported to date					
Newcastle—Reported to date					
U. K. Ports—Reported to date					
				500	
				200	
				75	

Total exports to Europe since opening of navigation.....16,434 220

Colliery Winding Ropes.—In the mining district of Dortmund, in 1887, at 91 collieries there were 201 winding ropes, namely, 32 flat steel ropes, 4 flat aloë ropes, 156 round steel ropes, 9 round iron ropes. Of the 3,005 winding ropes discarded during the sixteen years from 1872 to 1887, the following broke suddenly during working:—Of 309 flat steel ropes, 21, or 6.80 per cent.; of 147 flat iron ropes, 19, or 12.93 per cent.; of 86 flat aloë ropes, 6, or 6.89 per cent.; of 8 flat hemp ropes, none; of 1,598 round steel ropes, 51, or 3.19 per cent.; of 857 round iron ropes, 104, or 12.14 per cent.; altogether of 3,005 winding-ropes 201, or 6.69 per cent.; in 1872 out of 114 winding ropes, 22, or 19.30 per cent. broke suddenly. This proportion gradually decreased, until in 1887, out of 201 winding ropes, 3, or 1.49 per cent. broke suddenly.

Silver Milling in Montana.

In an excellent paper "Concentration before Amalgamation," etc., read before the American Institute of Mining Engineers, the operations of the Combination Mining and Milling Company, of Black Pine, near Lodge County, Montana, are described as follows:—

"The mill, as originally constructed by Messrs. Fraser and Chalmers for the Black Pine Mining Company, was an ordinary 10-stamp, wet-crushing mill, with room left between the battery and settling-tanks for concentrating machinery should it be found necessary to add it. As illustrating the impracticability of working these ores by raw-amalgamation alone a short summary of the operations of the Black Pine Mining Company may be given.

The mill was started on the 16th of July, 1887, and the run lasted until the 14th of September of the same year. During this period there were treated 1,178 dry tons of ore, assaying 17.5 ounces, and containing 20,615 fine ounces silver. Of this amount there was recovered in the form of bullion 9482.90 fine ounces, or 46 per cent. of the battery assay.

We need only note the points of difference between the Combination Company's plant and the form of mill ordinarily employed for treating silver-ores of the class usually termed "free-milling." These, as is well known, are so-called more because their low grade precludes their profitable treatment by the various other more efficient but vastly more expensive methods, than because they are better adapted to that process.

The ore is stamped, passed over four Frue vanners, the light pulp that goes over their "tails" being settled in tanks, shovelled into pans, and there amalgamated, discharged into settlers, and the resultant amalgam strained, retorted and melted in the usual manner. An analysis of these concentrates for the month of October, 20 tons into 1, gave the following result:

	Per cent.
Silica.....	32.50
Lead.....	9.10
Copper.....	8.22
Sulphur.....	1.19
Zinc.....	0.81
Silver.....	0.54

Samples of the pulp going to the pans for the same month show that it contained:

	Per cent.
Copper.....	1.05
Lead.....	0.48
Zinc.....	0.25
Sulphur.....	0.09
Silver.....	0.05

For the year ending May 31, 1889, the details of milling were as follows:

Dry tons crushed.....	9,061.965
Average assay, ounces of silver per ton.....	22.67
Gross contents of ore, ounces of silver.....	205,434.75
Estimated per cent. of reduction.....	80.70
Estimated product.....	165,785.84
Dry tons concentrates produced.....	541.805
Average assay of concentrates, ounces of silver per ton.....	136.17
Silver in concentrates.....	73,777.55
Silver in bullion.....	97,660.60

Total fine ounces.....	171,438.15
Actual per cent. saved.....	83.45
Total cost of milling.....	\$ 39,537.61
Average cost per ton.....	4.36

Batteries in service, 347 days, 5¼ hours. Average ore crushed per stamp in 24 hours, 2,612 tons. An analysis of the cost of treating one ton for the year gives the following figures:

Labor and superintendence.....	\$ 25,821
Salt and other chemicals.....	2,965
Fuel, at \$1 per cord.....	1,944
Castings and iron.....	3,846
Oils and illumination.....	1,066
Quicksilver.....	4,915
Miscellaneous supplies and team in yard.....	3,084

Total.....\$ 43,641

When the mill was started by the present management, an assay of the escaping slime-water was made, showing the value of the slimes carried by it to be 52 ounces in silver to the ton, or more than double the silver contents of the original ore. A series of carefully conducted experiments were at once inaugurated, and from them it was learned that three tons of these slimes, dry, containing 156 ounces of silver were passing through the waste-gate from the settling-tanks every 24 hours. These slimes were too light to permit of their being thoroughly settled by even the most extensive system of tanks, and to check this heavy loss, a China pump was placed in the last of the series of slime-tanks. This pump discharges into a small tank placed above and immediately in front of the mortars. It is only 1 foot deep, being made

shallow in order to prevent the gradual settling of slimes in it, and the consequent necessity of cleaning it out from time to time. From the side of this tank, and near its bottom, is the 2-inch pipe for supplying the water to the stamps. The only purpose of this tank is to furnish water to the stamps at uniform pressure. By prohibiting the use of any clear water in the battery, the escape of these slimes was very materially reduced, but this of itself was not enough to stop all overflow, as it would be in an ordinary wet-crushing mill, for reasons which will be explained later on.

The immediate effect of turning back into the battery, say two tons, every 24 hours, of slimes carrying twice as much silver as did the original ore (and this proportion of values has always existed), was to heavily "salt" our battery sample, and as the most rigid economy was essential to the commercial success of the property, the question of securing any accurate check on the mill became momentous. After careful consideration, it was decided to adopt the following system: Night and day samples are taken from the battery-launders in the usual manner, and are assayed daily with the other mill samples, but the results are corrected by the salting for the previous month. To determine this percentage, it is simply necessary to obtain the actual battery assay, and this is secured from the data furnished by the balance of the mill work, after the monthly averages are made up, in the following manner: The number of tons crushed, minus the number of tons of concentrates produced, must equal the number of tons amalgamated. The number of tons-amalgamated, multiplied by the average assay pan-sample, must be equal to total silver contents of the pulp amalgamated. This, added to the total silver contents of the concentrates produced, secured in the same manner, gives the grand total of five ounces of silver in the ore. This divided by the number of tons crushed gives the actual battery-assay. In this computation all tons are dry tons. The percentage of salting thus determined varies slightly, but the fluctuation is due more to errors in sampling than to any change in the actual amount of the salting. Usually, this is about 5 per cent.

But there was still a heavy loss in the escape from the settling-tanks of water carrying rich slimes, owing to the introduction of water at the heads of the vanners. To stop this, a small jet pump, using steam from the boilers and supplied with 50 feet of steam-hose for a discharge, was placed at the tanks, and slime water used in lieu of clear water for thinning down the pulp in the pans. While this corrected the evil, it also had the effect of increasing the difficulties in the way of concentration, as, in order to stop all overflow from the tanks, only as much water could be used on the heads of the vanners as was pumped into the pans, plus the evaporation.

After much experimenting it has been found, that with the limited quantity of water that can be used on the vanners, a speed of 180 revolutions of the crank-shaft per minute, with a belt travel of 3½ feet per minute, and an inclination of 3½ inches in the length of the machine, gives the most satisfactory results on these ores, although intelligent and constant adjustment is rendered necessary by reason of the changes occurring from time to time in the character of the pulp treated.

By reference to the details of milling for the year ending May 31, 1889, it will be noticed that the mill overran its assays 2.49 per cent., or 5144.63 ounces. As the actual battery-assay is determined by the assays of average pan and concentrate samples, and as the pan-sample is of necessity taken before the rich slime-water is pumped into the pans for the purpose of thinning down the pulp, the mill is bound to overrun, presuming perfect accuracy of sampling and assaying, exactly the amount of that part of the silver contained in the slime-water used in the pans which is amalgamated. As the greatest care is exercised to secure the most accurate sampling possible, and as in the assaying no deduction is made for silver in litherage, except in the tailings sample, the amount that the mill overran may safely be credited to the use of slime-water in the pans.

The pan charges have been changed constantly, according to the character of the pulp treated, and the amalgamation tests have been many and varied. The charge now being used, which seems to be the best tested, is 50 pounds of salt, 2 pounds of sulphuric acid, and ½ pound of cyanide, with 100 pounds of quicksilver strained in after the pan has been running 4 hours. The temperature of the pulp is raised by steam to 180° Fahrenheit, and the charge is run at 65 revolutions per minute for 8 hours. Settlers are run 14 revolutions per minute, and give good agitation with 3-inch shoes.

In the battery, 40-mesh brass-wire screen-cloth has been used during the past year, with the exception of about two weeks, when 30-mesh was tried by way of an experiment. After a thorough test it was found that the loss occasioned by higher tailings exceeded the profit accruing from increased crushing capacity, and the 40-mesh screens were replaced. The falling off in the savings during the time the 30-mesh screens were in use was largely owing to the fact, that the difference between the very finest of the slimes and the coarse particles that would pass through a 30-mesh screen was so great, that

with the increased quantity of pulp to be treated by the vanners, they could not be made to do close and clean work.

The concentrates produced, which thus far have been the final product, have been shipped to a smelter for treatment; but experiments are now in progress looking to their treatment at home, and it is highly probable that the necessary machinery will be added to the plant in the near future.

The Treatment of Fine Gold in the Sands of Snake River, Idaho.*

By T. Eggleston, Ph.D., New York City.

The sands of Snake River, Idaho, have long been known to contain gold. They were worked by some of the first prospectors who came to Idaho, and on the banks still stand the ruins of camps abandoned for years. There are almost always prospectors searching for gold during the season of low water, and it is not an infrequent thing to find a miner of the old type actually panning the sand, or the prospect-hole which he has just left. There is more or less mystery about these miners and their methods of finding the spots where they work. They are always subjects of much speculation to the ordinary traveller. The rich discoveries are, for the best of reasons, concealed until the claims can be taken up. It is difficult to find a place where there are no prospects, but the "colors" are so very fine that they do not offer much inducement to enterprise. The California miner usually values a color at from 5 to 10 cents, often the latter; while on Snake River it would take 100 colors, or even more, to make that amount.

There is not much difficulty in panning out the heavier pieces of this gravel, so that those which remain have not over half the diameter of a pin's head. Below this size the separation is extremely difficult, as the flakes are very thin. The heavier pieces of the hasalt, the black sand and fine gold remain persistently together; and, after the iron has been separated by a magnet, there still remains a material which appears grayish to the eye, has about the same gravity as the light particles of gold, and cannot be removed with an electro-magnet run by a very strong battery. After the heavy black sand has been separated by the magnet, the fine particles of gold float, while the gray sand sinks; so that I had the greatest difficulty in concentrating half a liter of material, taken up from under the head of the burlap sluice, into a bulk of 15 by 14 millimeters. A large part of the concentrated gold floats; and when, after much trouble, the surfaces are wetted and the gold is got under the water on to the top of the sand, the first wave from the other side of the pan over the sand floats the gold again.

The minerals contained in the fine sand are quartz, chalcedony, semi-opal, zircon, topaz and magnetite. I have not been able to distinguish any trace of pyrite, and have only occasionally seen small grains of peridot. These minerals are sometimes ground and broken, and sometimes are small detached crystals, which can, however, be seen only with high powers. The gold itself is in flattened forms. Almost every piece is convex and shows surfaces which are bright and more or less mammilated, having the appearance of having been acted upon by some reagent. They are quite similar to the artificial nuggets which I described some years since.†

It is a question of interest how this gold got into the sands. The most probable answer seems, at first sight, to be that it came from the abrasion of the rocks. This leads to the further question, Why is it, then, so very much finer than gold-sands ordinarily are? I do not pretend to be able to answer these questions decisively now, but hope to do so at some future time. The object of this paper is rather to describe the method in use for catching a part of the gold.

Snake river, during the course of nearly 100 miles, which I have studied, runs through a columnar basalt. The rock covers the plains, where the surface of the flow is covered with great nodules from 15 to 40 feet in diameter, and from 10 to 12 feet high, which have a radiated and at the same time a columnar structure. The erosion and destruction of this rock has formed the sands of the great Idaho desert. The rock is much fissured and is covered only to a slight depth with sand. It is generally compact, but the surface of the ground is covered in some places with small pieces so full of bubble holes that they appear like scoria. All such pieces have a more or less large coating of silica on them. It is in this rock that the Lost river disappears, to come out again, as is generally believed, in one of the numerous large springs which flow from the north side of the bluff below Shoshone Falls.

The Oregon Short Line railroad crosses Snake river at American Falls station, where the river is 1,500 feet wide and descends 50 feet in several falls 10 or 15 feet high between bluffs 30 to 60 feet high. It runs west in this way a little over 100 miles, the bluffs on both sides of the river gradually growing deeper, until at what is known as Twin Falls the river suddenly falls 175 feet, leaving the bluffs 500 feet high. In the course of the next 3 miles it forms

Shoshone Falls, where the river first narrows to 750 feet in width and then takes a jump, first of 75 feet and then, within a few yards, of 210 feet, leaving the bluffs at the foot of the falls 1,200 feet high on both sides of the canon and the river 1,000 feet wide. The top of the bluffs is a very hard compact basalt, with occasional small modules of chalcodony, but only in a single place, just above the Twin Lakes, below Shoshone Falls, did I see in this top rock any large holes, and nowhere any appearance of weathering or decomposition in the rock itself in place. The rock is in many places coated with a white covering of silica, formed by the evaporation of the water percolating through or collected on the surface. These coatings sometimes take fantastic shapes, as in the case of the Devil's Spade, about a mile above Shoshone Falls, where what appears to be a painting in white of a gardner's spade can be seen in a niche just below the top of the bluff. Notwithstanding this deposition of silica, the rock shows to the eye no trace of decomposition. I was told that the iron pyrites is found in modules in the upper part of the bluffs; but I did not see, in the course of more than a week that I spent on the river, a single piece of iron pyrites, however small, though I looked carefully for it. Below the great Shoshone Falls, on the level of the river, the rock is porphyritic, light gray in color, and much more felspathic and friable than the basalt above, and thoroughly rotten from decomposition. About 100 feet from the foot of the falls it is so worn away that I crawled through apertures in the decomposed rock for 25 or 300 feet, at a distance of about 10 feet above the water, the outside of the rock still being intact. This decomposition is much like that which occurs in the sand-rock of the Kentucky River, near Jackson, Ky. It is not an uncommon thing in the various side-canons which lean into the main canon of the river to find that the bottom rock has been so much decomposed, by the absorption of its alkalies, or so much washed out, that pieces of the overhanging hard rock, 50 to 75 ft in length and 8 to 10 feet in width, have dropped down, retaining their vertical position, leaving a chasm 2 or 3 feet wide between them and the main rock. Striking examples of this occur in the side canon near the Twin Falls and below the Great Falls.

This decomposition of the underlying rock has taken place on a very large scale, and is particularly visible just above and for a considerable distance below the main falls, so that the surface for 500 feet from the main fall is broken up into what appears at first sight to be small terraces, which are difficult of access. From the top of the cliffs this sinking of the rocks gives an appearance, on a very small scale, quite similar to the grand canon of the Colorado river, as seen about 75 miles from Flagstaff, Arizona, when the same phenomena takes place on a different rock, on a scale probably larger than anywhere else in the world. The water of the river is cool, and slightly alkaline to the taste. The soil is full of alkali, which is undoubtedly one of the results of the decomposition of the rock. It is also probably one of the sources of the solution of the gold, and its subsequent deposition in the sands of the high banks as well as the deposition of the silica minerals formed by evaporation.

It is a fact well known to those who chlorinate pyrites concentrates, that the gold they contain is in all degrees of fineness; that, in some cases, it is extremely difficult to attack the gold; and that, in other cases, the loss in roasting is enormous, on account of the very large surface, as compared to the weight, of the gold particles. It is known that the gold is much finer in some pyrites than in others, and I supposed at first that this might account perfectly for the condition of the gold in these sands. The microscopic examination, however, does not justify the conclusion that the gold has come exclusively from the decomposition of pyrites; since in no case have I been able to find any gold that was coated, or the surface of which was not just as bright as if it had been for a long time exposed to chemicals. That small quantities of gold are contained in solution in the waters flowing through these rocks seems to be probable. The experiments that I have been able to make in the laboratory tend to confirm this opinion.

Snake river, below Shoshone Falls, runs for 18 miles through basalt, the height of the bluff varying from 1,200 feet at the falls to about 500 feet at the end of that distance. It then commences to widen out gradually, the talus of sand increasing little by little in height until at last the outlines of the rock only, come up at the top of the bluff. These finally disappear; and what was a talus becomes sand-hills on the south side, and, on the north, more or less irregular sand-bottoms, with cliffs of basalt varying in height, but generally not more than 30 to 40 feet high, so that in several places roads have been constructed in the side canons from both sides down on to the bottoms. On the top of the bluff there is no water. The rock is columnar and very much fissured. It dips south, so that there are no springs on the south side of the river, but all along the north side at intervals of three or four miles great springs gush out, which form at once considerable streams, issuing directly from the rock.

The river bottom-lands widen from nothing to about half a mile. They rise above low-water mark as much

as 30 to 40 feet. Where it is possible to get water to them, either from the springs on the north side or by flumes taking water high up the river on either side, the sands, after the alkali is washed out of them, make excellent soil, and in both ways some beautiful ranches have been made.

The sand in the river contains some gold, not in large quantity anywhere. It is so very fine that it is difficult to collect it without special apparatus. The gold value of these sands is estimated at about five cents to the cubic yard, which includes top soil and bottom gravel as well. The pay-streak is richer than this, but in the working it is impossible to make any separation.

The pay-streaks, after prospecting, are worked on both sides of the river. There are a number of these placer-workings about 50 miles below Shoshone Falls, which have been operated for a number of years by a method but little known. One of these, known as Hunt's placer-claim, at Salmon Falls, which is 17 miles across the desert from Bliss Station on the Oregon Short Line Railroad, I had occasion to visit in the summer of 1889.

The method of excavating the sands is simple. It consists in bringing a ditch into the pay-dirt, and making the ditch itself do almost all the work of excavation. The fall of the water breaks the ground down, and sufficient grade is given to carry it to the machines. The best grade for the water-ditch has been found to be 4 inches in 12 feet. Ditches with earthen banks, and flumes, sometimes partly in earth, and at others wholly on tressels, are used. When the ground-sluice is not over 36 inches wide, gravel runs easily on a 4-inch grade. The long flumes have a grade of $3\frac{1}{2}$ inches to 12 feet. The ground-sluice is made so as to gradually work back, cutting itself out by the fall of the water. The top soil is broken back by the pit-man with a steel bar, and the lumps are broken up with a light pick. The pay-gravel varies from 10 to 25 feet in thickness, and has to be washed in benches, taking from 5 to 8 feet for a bench. No ditch is required in the gravelly places. The stream is directed around the bank by the pit-man, who uses "shear boards," 14 inches wide and 2 inches thick, with round sticks 1 foot long and 2 inches in diameter, run through them as handles. These are so placed as to direct the water against the bank, to undermine it slowly, so that the sands cave, but not so rapidly as to impede the course of the water. These planks require the constant attention, in the day time, of one man in the pit, who in ten hours will bar down ground enough to keep the machine working for twenty-four hours. The skill of the pit-man consists in so barring his gravel and arranging his shear-boards that the pit will take care of itself at night. The current must be strong enough to carry all that falls into the sluice leading to the machine. Occasionally, the ground-sluice is dammed by the gravel in the night, and cuts a channel in such a way as to make it impossible to reach certain blocks of ground. This is not, however, a serious inconvenience, since the ground has to be broken in benches, and the spot so left is taken in, in working the bench below.

The stream carrying the broken-up gravel runs through sluices, in general not more than 24 inches wide. But, from about 8 feet before it reaches the first iron plate of the machine, the sluice is enlarged, so that where it meets the plate it is 4 feet wide. The machine consists of a board-sluice, lined with perforated sheet-iron plates, 3 by 4 feet in size, which are called "grizzlies." Below them, on both sides, is an inclined sluice, leading to an undercurrent, which discharges into sluices covered with burlap, called "sack-boxes." The width of the machine is constant, but the length varies with the fineness of the gold to be caught. At Hunt's claim there are three—one 24, one 30, and one 36 feet long. The flume that carries the gravel is 1 foot lower than the top of the "grizzly." The sand accumulates here and makes a pavement, and prevents the wearing of the bottom. In some of the small machines this sluice is paved for some distance with wooden blocks placed on end; but all of them have blank plates for the length of one plate, at least, set almost without grade; and these have been found to wear best, as the water builds its own grade from the sluice to the machine. The blank plate is 4 feet long. It is made, like the other plates, of steel or coke iron, 5-32 of an inch thick. The grizzly-plates are perforated with conical holes, $\frac{1}{2}$ an inch between centres, which are 5-32 on the top and $\frac{3}{8}$ on the bottom, to prevent the holes from clogging. These plates are 3 feet long and 4 feet wide. The sides of the sluice are made of boards, 1 inch thick and 12 inches wide, except just over the undercurrent, where they are 2 feet wide. The grade of the "grizzlies" varies from a $\frac{1}{4}$ to $\frac{3}{4}$ of an inch, according to the size of the gravel. The coarser it is the more grade is required. In setting up the machine a frame is first built, and on this the grizzly is placed loose, so that the grade can be changed if necessary by wedges placed underneath it. Ordinarily, $\frac{1}{2}$ an inch to the foot is found to be the best grade. When the grade is determined, the grizzly is wedged firmly to its place. At the end the grizzly discharges the material too large to go through the holes into the tail sluice, which must have sufficient grade to carry off all the tails. Below the

grizzly the sides incline both ways towards the center at the rate of 2 to 3 inches, or more, to the foot, and end in an undercurrent called a "sand-tank," which is 4 feet wide. This has a grade of $1\frac{1}{2}$ inches to the foot, towards each side. It is generally placed immediately under the center line in the middle of the machine, but its exact position depends on the lay of the ground. In its center is a sump, 4 inches lower than the lead-boxes, so as to distribute the water equally to the burlap-sluices on each side of the machine. These are 4 feet wide, incline $\frac{1}{2}$ to $\frac{3}{8}$ of an inch to the foot, and are arranged according to the length of the grizzly. For the 36-foot grizzly there are twelve of them, six on a side; for the 30-foot, there are ten, five on a side; for the 24-foot, there usually are only six, three on a side. Four would work better. The grade of the lead-boxes is $\frac{1}{2}$ to 1 inch to the foot. The lead-sluices are arranged so that the back one carries the gravel to the sluice furthest away from the machine. They are 10 inches wide. In order to distribute the sand evenly in the width of the sluice, there are four divisions at their head, which vary in length so as to distribute the current equally. At their upper end there is a movable grating made of strips of wood, set inclined, to keep out any floating matter which may accidentally get in, and to further distribute the stream. The sluice-boxes are 3 feet wide, and 24, 30 and 36 feet long; made of thin boards placed end to end. The sides are 6 inches high and are nailed to the sides of the bottom boards. They have a grade of $\frac{1}{4}$ to $\frac{3}{4}$ of an inch to the foot. If the material treated is all sand, which is the usual case, the grade is $\frac{1}{4}$; if gravel and sand together, $\frac{3}{4}$. These burlap-sluices connect with the tail-sluice by a sluice at their end, at right angles to the main sluice, which is 3 feet wide and has a grade of $\frac{1}{2}$ an inch to the foot, over which the burlap-sluices project 6 inches, and which projects 2 feet beyond them. These sluices, like the grizzly, are set on a frame, so that the grade can be changed by wedging, and when once determined on, can be set firmly in place. As the tail-sluices are on both sides of the machine, they discharge in front of the grizzly with sufficient force to move all the tails down the main tail-sluice.

At the head of the burlap-sluice, just beyond the wooden gratings, which regulate the flow of the gravel, is a cross-bleat, under which an iron plate, 1 foot wide and as long as the width of the sluice is fitted. This is made of old grizzly iron. It is held down at the side by a cleat, under which it slips.

The sluice is covered with burlap 40 inches wide. It has been found by experience that 7 ounces to the yard is the best burlap to use. Heavier and lighter have been used, but are not found to answer so well. The lead-sluices have a grade of 1 inch to the foot; when the plate is put on them, there is a slight drop; and here there is always gold to be seen at the clean-up. Each of the lead-sluices is so arranged that it can be cut off separately. This is done by a gate of wood wrapped with burlap to make it quite tight and, in order to further keep out the water, the burlap, which is to go on to the sluice after the clean-up, is thrust into the lead behind the gate, which prevents the passage of water and at the same time wets the burlaps, so as to fit it to be spread out on the sluice. These gate-wrappings, as soon as the clean-up is finished, are hung up on the east side of the grizzly, so as to be ready for use at the next clean-up. The burlaps on the sluices are held down by cleats of wood, kept in place by wooden eccentrics, screwed to the side, so that when they are turned down, they hold the cleat in place. These cleats are $1\frac{1}{2}$ by 1 inch and are cut from a 1-inch board. After six years' use some of them are so worn that they have to be turned up on their angles to meet the eccentrics. In the 24-inch sluice there are six of these on each side.

To make a clean up, the man in the pit comes down to the machine with the superintendent, and the water is turned off from each of the sluices, one at a time, commencing always with the outside sluice. The assistant has a piece of flat rubber set in a handle. He knocks down the eccentrics on both sides of the sluice to be cleaned, with the handle, so as to loosen the cleats. These are then taken out, washed in the next sluice and placed crosswise over it, to be at hand when wanted. The superintendent takes out the iron plate at the top and carefully scrapes off the sands and gold, washing the plate in the next sluice. The assistant takes the burlap from the bottom, brings it up to the center of the sluice, and commences to push with his rubber the material collected underneath the burlap on the bottom from the lower end to the middle of the sluice. The superintendent carries the top of the burlap to the middle, folds it to 18 inches and the width of the sluice, then doubles it over towards the side of the sluice, presses it flat with his feet, and places it in one of the boxes. There are two of these boxes for each sluice. They are 18 inches long, 13 inches wide, and $7\frac{1}{2}$ inches deep, and are lined with tin. The woodwork of the boxes is only knocked together, but with constant use they last four years. When the tin commences to rust through, so that they leak, the boxes are used exclusively for the burlaps. The tight boxes are always used for the sand. While the superintendent is

arranging the blankets, the assistant goes to the top and pushes the sand down to the middle, to be put into the other box. When the sluice is clean, the fresh-wetted burlap is taken out of the lead-sluice, the upper end being held by the superintendent and the lower end by the assistant, and stretched with both hands over the sluice, leaving the upper end of the burlap to project over the upper end of the sluice. The burlap is shoved under the cross-cleat by the iron plate, which is cut off at the corners to prevent cutting the burlap; this goes under the cleat and is held fast, leaving about 2 inches of the burlap projecting over the top of the plate. The side-cleats are now taken from adjoining sluice and put in, commencing at the top. On their hands and knees the two men go from the top to the bottom, pressing the cloth in place, spreading the burlap so that it comes up to the sides of the cleats and sometimes over the top, according as it stretches. They then turn down the eccentrics, put in the grating, and turn on the water. This work, in a single sluice, takes five minutes. The next sluice is treated in the same way, and so on until the clean-up is completed. They are careful to spread the burlap tight and smooth; for, if it is wrinkled or bulges, sand collects under it and less gold is caught. If they are properly put down, only two or three pans of sand will be thus collected which, at the head of the sluice, contains considerable visible gold. Most of the gold, however, is caught in the burlaps.

The burlaps are cut so as to cover the whole length of the sluice and lap over the lower end; but they wear, and after some use grow short, so that they are generally 18 inches to 2 feet shorter than the sluice. The lead-sluices at the head of the burlap-sluice, which distributes the stream, are keyed in and are kept together by diagonal strips. The grating is put in loose, 6 or 8 inches from the slats.

Nothing but burlap has been found to answer for this work. Ducking was used at one time, but it did not catch the gold so well and rotted too fast. The burlaps are used until they go to pieces from rotting. They usually last two months. When worn out, they are used around the gate. When they can no longer be used, they are dried and burned, and the ashes are panned. In order to prevent the closing of the pores by vegetable matter, the burlaps must be spread out in the sun to dry thoroughly after each clean-up, to destroy the plant-life before they can be used again. They last longest in summer. In the winter they are apt to tear from freezing at the sides. The whole work of the three machines is done by five men,—one man in each pit; the helper, who does other work; and the superintendent who, with the pitmen, makes the clean-up and "rocks" the dirt.

Over the 24-foot machine, 200 to 250 inches of water are constantly run in 24 hours: on the 30-foot, 350; and on the 36-foot, 400 inches. The work done on each machine averages about a cubic yard of gravel for each miner's inch of water used. The essential requisite is to secure a good dump; unless this is done, the tail-sluices will soon be filled up. Usually, on Snake river the spring freshets wash the tail-sluices out; but for two or three years, on account of the low water in the river, this has not been the case. It is also necessary to set the bed-rock sluice in such a way that there will be plenty of water the year round. In some places it has been set too high, so that when the river is low there is no water to wash with, while there is plenty of water in the river. Not only plenty of water, but free water is essential to the economical success of this process.

The boxes from two of the machines which are at a distance, are cleaned at a shed near the house, half a mile from the sluices. In one which is difficult of access the rocking is done on the spot. The clean-up house is 14 by 12 feet. On the long side against a window is the washing-tank. An ordinary gold-sand rocker is placed at the end next a window, and the retort-furnace opposite to it. The boxes containing the burlaps are piled next the washing-tank. The sand in the boxes is piled next to the rocker. The washing-tank is 10 feet long, 3 feet wide and 3 feet deep. It has a shelf 6 inches wide behind, and one 4 inches wide at an angle of forty-five degrees in front. The burlap taken from the box is washed several times up and down in the tank, where water is constantly running in and out. It is then allowed to fall into the tank; the end being held by the hand, is washed by shaking it on to the front ledge, and is then folded backward and forward so as to make the folds 1 foot wide. It is then thrown on to the ledge behind. The gold sand from the burlap which remains on the front ledge is then washed into the tank, the end of the burlap is brought over on to the front ledge, while the rest remains on the opposite ledge, and the space between the two parts of the burlap washed up and down and again folded on the front ledge. This is repeated twice; so that each burlap is washed three times. The ledge is washed every time to throw the gold into the water. The washing is done at some distance from the discharge-pipe, to avoid the danger of the fine gold floating off. The sand collected at the bottom of the vat is allowed to settle until the water is almost clear. The water is drawn off from above at three plug-holes, at different levels, and the sand collected is rocked. The

rocker has a plate 60 inches long by 24 inches wide. The end and sides are turned up 1 inch, so that the inside space on the plate is 22 by 59. The hopper, into which the sand is put, is 13 by 15 inches, and 5 inches deep. The bottom of the hopper is made of a grizzly plate and the constant washing has worn grooves laterally towards the holes. The inclination of the plate is $2\frac{3}{4}$ inches in 2 feet, which experience has shown to be the best. The plate is copper and not silvered, silver-plated plates not having been found to answer. The plate is first washed with a swab soaked in potassium cyanide. Then mercury, sprinkled half way down through a fine cloth placed over the end of a bottle, is wiped over the surface with the cyanide swab. The sand is put in at the hopper and the rocker is rocked seventy-eight times a minute. What comes off the plate runs into a tail-sluice, and carries almost no gold, not more than two dollars to the ton. About seven small coal-shovels full are worked in a minute, care being taken never to clog the holes. This is all that is done with the sand from the boxes. The sand from the tank is mixed with cyanide, the proportion being determined by trial, and allowed to stand two hours before rocking. The moment the rocker is stopped, the end of the amalgamated plate is turned up so as to drain to the back, to prevent the loss of mercury and amalgam. Each machine is cleaned twice a week. The 24-foot treats from 78 to 80 tons per day, and the others correspondingly more. The gold collected by this method is very fine,—much finer than any that I have seen, except from some of the Arizona placers.

The machine runs itself, with only one man in the pit. It pays to run sand which has from 50 to 85 colors. These machines collect from thirty-five to forty dollars a day each. The work of the clean-up varies with the size of the machine. With the 30-foot machine, all the work of cleaning up the sluices, washing the burlaps, spreading them out to dry, and rocking, is done in six hours. The 36-foot machine takes an hour longer, and the 24-foot an hour less.

This method is one of the least expensive of all the devices for the treatment of fine gold. It requires but little capital and labor, and the returns well repay the men. It requires, however, free water. By changing the grade of the machine and sluices, and multiplying the number of burlaps, very close work can be done.

* Paper read at the Ottawa Meeting of the American Institute of Mining Engineers.

† *Trans.*, ix, p. 633.

Coal-Mining and the Duties of Colliery Managers.

The following address was given by Mr. William Rogers, J.P., F.G.S., at the annual meeting of the National Association of Colliery managers, held at Wigan in the North of England.

Every intelligent workman, before commencing operations in his particular trade, necessarily considers well the material he has to work upon, the object he desires to obtain, and the tools he has to work with; and before he is an efficient manager he must further know what is the necessary knowledge he must acquire in order to place him in this position. Our first point of enquiry, therefore, must be this, viz.:—What is this coal, the material upon which we have to work? Time does not permit me to enter into a scientific description of the origin or formation of coal; we all know that it is supposed to be a vegetable formation, in some cases of large forest trees, and in others of more humble origin in the shape of lower growth, such as ferns, moss, &c., which by peculiar coverings of water and soil has escaped the ordinary and natural decay so general in all vegetable matter; but there are coals and coals, and it is of the greatest importance, before you can arrive at the best mode of working any particular stratum of coal, to see that you clearly understand its special nature. For instance, some seams of coal may be hard, others soft, some seams thick, others thin, some seams are intervened with bands of foreign matter of varying qualities; the strata also above and below the seams to be operated upon want due consideration, such as the nature of the roof and floor, and if the field is disturbed or dislocated by faults they also form an important element in arriving at a right conclusion as to the best mode of opening it out. All these indicate to you not only the vast importance, but the absolute necessity of a certain amount of geological knowledge, which will make your work not only more interesting, but far more efficient and valuable. Formerly the study of geology was confined to, comparatively speaking, a few scientific men who had both leisure and special training to pursue it, but now, happily, we are living in an age when there exists a desire and a real endeavour to combine theory with practice in all branches of industry, and the facilities for your acquirement of the amount of geological knowledge necessary for any of yourselves are greatly multiplied; these are advantages possessed by colliery managers of the present day which were utterly unknown by your predecessors. If it had been a compulsory study for all workmen seek-

ing advancement as a colliery manager, numbers of areas of acres of coal now unworked would have been opened out, and work found for thousands of our artisan classes, and on the other hand thousands of pounds would have been spared the country in foolish attempts to find coal where none could possibly exist. To some geologists the idea years ago prevailed that coal did exist where it has lately been discovered through the borings for the Channel Tunnel, and I think I can safely predict that there are yet existing vast fields of coal which at the present time are not even thought of. It may, however, be said, and with some truth, that the prospecting for coal is more the province of a mining engineer than a colliery manager, but surely an intimate knowledge of the strata, through which a sinker has to pass before reaching the coal, is of the utmost benefit to the colliery manager.

The history of mining is lost in the traditions of the past. Early Scripture history shows us that the Egyptians and other nations were intimately acquainted with metalliferous mining, and before then mining was extensively practised by Asiatic races. When the use of coal came first into existence history is altogether silent or very vague. In this country, I believe, tin and copper mining were first known in Cornwall, but the early stage of coal-getting can hardly be dignified by the name of mining. There is scarcely a mining district where the coal crops out to the surface that has not extensive remains of day-eyes or tunnels driven from the surface. The extent of such tunnels was of necessity limited by measure of the animal power that could bring the coal from the face to the entrance of the eyelet or tunnel, or where water existed, to the limit of drainage power. Of course, in those days the use of coal as a general article of consumption was comparatively very limited. In many places (and I believe this state of things can be remembered by some now living) the coal had to be conveyed on the backs of pack horses to the nearest points of distribution. This limited demand naturally prevented any systematic mode of getting it, although in a few more populated districts shallow shafts were sunk, and windlasses or whimseys were utilised for the purpose of raising it. It is amusing and interesting to anyone, but especially to colliery managers, to contrast the very clumsy and yet simple methods of getting and dealing with coal in the past with the wonderful advantages we now enjoy. Really and truly, mining in the strict sense of the word did not become a practical science until the successful application of steam power to colliery operations, completely revolutionising the whole trade. Rapid indeed was the progress of coal-mining when the steam engine as an effective machine came into popular use, creating at one and the same time the demand for coal as the feeding power of the mechanical steam horse, and the means of winning the same, by bringing it from the face of the mine to the bottom of the shaft, and again from the bottom to the surface, by clearing the mine, by steam pumps, of its old enemy, water, and by ventilating it either by furnace or fan of the deadly foul air and gases so fatal to the thousands dependent upon it for their livelihood, and last, and by no means the least, by distributing it at a cheap cost over the United Kingdom, and even over the mighty seas which lap our shores. The power of steam was known thousands of years ago; its useful application scarcely goes back beyond the last century. From that useful application has sprung up untold wealth to the world. We have it upon indisputable authority that at the commencement of last century the pit shafts in the north of England—afterwards to become the greatest coal district in the world—were only a few yards in depth, none exceeding 50 yards; there was no mechanical haulage underground, the coal was actually carried from the working-places to the pit bottom on the heads of women and children; a slowly-revolving whimsey, propelled by some animal, performed the operation of winding and pumping; and upon reaching the surface, horses and mules conveyed loads not exceeding 3 cwt, of coal over very bad roads, across hill and dale, for shipment. At that not very remote period there was no other mode of conveyance. Ventilation needed no appliances because the workings were so limited in extent, and the persons employed so limited in number, that natural ventilation fulfilled all requirements. Somewhat later, roads for the better transit of coal were made, and consignments of something approaching 17 cwt. were made possible in carts. Then wooden rails were laid as a help to the carts, and afterwards wagons were used, provided with sails.

The rapid development of coal mining causing extensive workings at nearly every pit presented a new and serious risk to the workman in the form of explosive gas—hitherto the chief danger being firedamp and (what is still too much the case) falls of roof. This explosive gas was the cause of many and appalling losses of human life, hundreds of poor fellows at one instant of time being killed and mutilated, and thousands of pounds lost in damage to the workings where they occurred. It is also true that even now the world is not exempt from the recurrence of these explosions, but what would have been the extent of them had not Sir Humphrey Davy

invented the safety lamp, it is appalling to think. The greatly-extended workings of the present day necessitate increased ventilation, and this is a subject that every colliery manager should never lose sight of. The more rapid velocity of air through the workings has to some extent lessened the safety of the lamp, as there can be no doubt that explosions have taken place through the current of air being driven through the wire gauze hitherto so impervious; there again the existence of a new danger leads to the effort to discover a suitably remedy. New lamps to meet this difficulty have been introduced in a great many instances, but, in my opinion, the safest lamp, without at all depreciating the excellence of the electric lamps, is yet to be found in some modified form of the old and tried friend that has served the collier for so many years. I would, however, impress upon all colliery managers the old proverb, "Prevention is better than cure," and he is the best manager who, by carefully distributing a sufficient quantity of air (not only in the working-places, but also through the goaf) prevents the possibility of the formation of huge gasometers.

This slight sketch of the progress of coalmining brings us to our present favoured position. As compared with the old days of manual labour, ill-directed and badly applied (being merely a labourer's calling), we have a trade requiring all the assistance that science (in the form of geology and chemistry), skill and appliances in the forms of engineering, both mechanical and mining, can give us. We require stores and implements unknown and unthought of in its early history, and many trades have sprung up in connection with mining, finding employment for thousands of our labouring classes, wire and steel ropes, steel rails and wheels, iron castings, timber and other utensils too numerous to specify in detail requiring a training for the position you gentlemen now hold, second to none in the industries of this country. We now have pit shafts sunk to a depth of near upon half-a-mile; powerful winding engines hundreds of horsepower, worked by steam, and raising tons of coal at each journey at speeds equal to that of an express train; workings extending for miles from the pit bottom, and mechanical power conveying expeditiously large trains of coal from the working places to the cage; magnificent pumping appliances placed above ground or below, and capable of raising any quantity of water from any depth; enormous ventilating machines passing through the workings of a colliery not merely tons, or even hundreds of tons, but thousands of tons of air per day, and capable of running night and day for years. And much as has been done during our own century, the next will, in the opinion of many who are competent to judge, be equally fruitful of improvements. Shall I, at this point, without trenching on a later portion of my remarks, suggest that the wonderful invention of electricity, still in a state of infancy, will probably advance to giant's growth? Shall we have it applied not merely to signalling, but to pumping and winding and hauling? and in the actual getting of coal? Greatest perhaps of all, will the dim light with which we now grope our way amidst the darkness underground, contending with dangers more difficult because unseen, pass away? and by an effective and safe and comprehensive application of electric light, provide us with an illuminant in every part of our mines, equal to the light of day?

To a certain extent the mining schools of this country have rendered most efficient service in providing for the requisite knowledge in chemistry, mechanical engineering, &c., but I should like to see the day when these schools are not only used by aspirants for certificates, but those who, having acquired them, still desire to extend their knowledge, and apply it to the special works under their control. I am convinced that the better chemical acquaintance with the seam of coal a manager has to win, and an extended acquaintance with the science of mechanical engineering would frequently assist the firm he is connected with in various ways, such as finding the most suitable or particular coal markets, and he would save them hundreds of pounds in more ready mechanical contrivances for drawing and raising it to the surface. I believe that great benefit would arise to the trade generally if the managers would seek out and encourage miners of thought and experience, so that by their aid a more easy and effective method of winning coal would be soon discovered at a cheaper cost, resulting in increased wages to the collier with less trouble to himself, a less percentage of small with a greater percentage of round, and a greater employment for labour.

A colliery manager's first duty is to provide for the safety of the men under his employment. This is a short sentence, but what does it not embrace? No mine can be safe unless all the details essential to mining are carefully thought over and carried out. Parliament has wisely set out certain rules to guide a colliery manager, but these regulations only touch the fringe of what ought and must be done before the maximum amount of safety can be secured. He is, indeed, a poor manager who thinks he has done all that is required of him when he has committed to memory these rules and reduced the same to practice. In order to prevent accidents from

gas, too much attention cannot be given to proper and sufficient ventilation both in the goaf and working places; also, to prevent accidents from falls of roof, a regular and systematic inspection of the main roads and working places must be made; and, further, to prevent the numerous miscellaneous accidents, uniform attention must be given to propping, inspection of the main roads, machinery, and all working places.

The next duty of a colliery manager is to see that he gets his coal at the cheapest possible cost, consistent with the safety of the men under his supervision and the efficient opening-out of the mine. It will be seen that very much depends upon considering in the first instance a well matured plan. This is of the utmost importance, and I would urge upon managers, after having carefully considered their plan, not to deviate from it unless some glaring error is manifest. Many good collieries have been rendered too expensive to work by ill-advised and badly-matured plans, and even in some cases through having been worked haphazard without plans at all. One great point is not to open out the mine too extensively at one time, thus incurring large dead expense in keeping open the requisite roads and airways; another is to have as short drawing roads as possible, for the great aim of every manager should be to keep the collier and his drawer as much occupied at the face of his place as possible. The various systems of mechanical haulage, whether tail-rope or endless rope, and whether driven by steam or compressed air, enable us to overcome all difficulties under this head. Again, too little attention is, I fear, in many cases paid to the saving of timber, pit rails, coal tubs, &c. There are few concerns that at one time or another have not to lament the loss of rails, and more old timber is lost annually than can be imagined, from neglect to draw it when opportunity arises. Another great point is to see that the proportion of small to round is kept at the very lowest point. The annual loss under this head is something enormous, and I should say that a manager who can decrease this percentage is almost as great a benefactor as the celebrated agriculturist who could grow two blades of grass where one grew before. A great deal depends, of course, upon the nature of the strata lying above or below the seam to be worked, but where holing is possible in the warrant it should always be strictly followed out.

Again, in these heavy days of competition, the condition of the coal as far as cleanliness is concerned is a great and important subject for attention. I have seen positively unmerchantable coal take a fair position in the market where this point has been carefully watched and attended to. This opens out the wide subject of coal picking, coal sorting, and coal washing, on which we have not time to dwell.

Lastly, there is the great and important question of output, and here I would point out the necessity of a manager studying the interests of the miner under his charge. The get of any one collier is of as much importance to the concern he serves as it is to the collier himself—what is a loss to the one is also a loss to the other. Short drawings, plenty of empty tubs, good roads, sufficient props, quick despatch of full boxes means filling the pit with good workmen, while others are short-handed. Above all, I would impress upon you the fact that colliery managers are men of position who should respect their office and themselves if they desire to have it respected by others; they should be courteous in manner to those under them while firm in their determination to see that all do their duty—violence, hasty temper, and bad language only degrade, and do not assist the manager in controlling those under him; a kindly word and an interest so far as is practicable in each collier's work under him is a surer method of having his wishes obeyed.

I have purposely avoided dealing with any special subject of a controversial character, pointing out the goal all should strive to reach rather than the means by which it should be arrived at. Time would not permit me going into the numerous questions of detail. Let safety and cheapness of output be your watchwords so far as the management of the mines under your control are concerned, and courtesy, firmness and fairness be your watch words so far as the men are concerned. The human machine, remember, is far more intricate to manage than the natural laws that govern mining. First learn how to govern yourselves, and then the watchwords I have given you will assist you in managing others. I am by no means an enthusiast, and do not expect the day will ever arrive when men, having separate interests, will arrange them without some friction, but of this I am convinced, that where courtesy and firmness are displayed on the one side it will be more or less reciprocated by the other, and that where interests are mutual there will be a mutual desire to make them so.

Messrs. Dobbie & Stewart, Thorold, Ont., have issued a handsomely illustrated catalogue of their specialties in machinery for contractors, miners and quarrymen.

The new works of the Canadian Rand Drill are now in full swing under the management of Mr. F. A. Halsey, formerly of the New York establishment.

The General Phosphate Corporation.

The statutory general meeting of the General Phosphate Corporation, at Cannon-street Hotel on Tuesday, 16th Sept. was a lively affair.

The Right Hon. Lord Stalbridge was in the chair, and in the course of his address he said:—

Ladies and Gentlemen, as you are all aware, this is the first ordinary or statutory meeting of the company, and it has been called perhaps rather earlier than the extreme limit which is allowed by law, in order to make you fully aware of the present arrangements of the company. Of course it is not possible to go into great detail, but still we thought it was only right that you should know exactly what has been done. In Canada, as you have seen, there appears to have been a general scream of delight at the operations of your corporation, and every owner of either what was real good phosphate property, or what was thought was good phosphate property, furnished up his lands, such as they were, and hoped, by some means or other, to foist them at once on this corporation; but I can assure you that your directors intend to be in no hurry in purchasing properties without making themselves thoroughly acquainted with the value of those properties. We are now at this moment entering into provisional contracts for the purchase of two what I trust will prove valuable properties to the company; but before doing so we intend to make ourselves thoroughly acquainted with the value of those properties. With that object one of the directors, Sir George S. Baden Powell, M.P., who is thoroughly acquainted with Canada, and with all the leading gentlemen in that Dominion, has gone off to Canada, and is there now. Our able solicitor (Mr. Davidson) hopes to leave also shortly for Canada in order to perform the legal part of the business, and examine the titles and so on. We hope by means of these two gentlemen, aided by experts, in accordance with the aims laid down in our prospectus, to be, before the end of our first year, the possessors of valuable and good properties. Of course, the difficulty with such a property as ours is to obtain a thoroughly valuable output, and we do not intend to purchase any properties without obtaining guarantees from the vendors that the output will come up to what they assert it is to be, both in quantity and quality. In that way we hope to pecuniarily benefit the corporation, and to become the owners of valuable properties. More than that, we do not intend to run before we can walk. We do not propose to proceed too fast, and we certainly shall not take every property that is offered to us. I can assure you that the list of properties that have been offered to us would reach nearly from here to Charing-cross; but we do not intend to proceed without the utmost caution. I regret to say that two of our directors have resigned, from causes over which they had no control. Mr. Sampson Lloyd finds that the times at which the board meet are not those which enable him to give that attention to the company which he would like to give, and he has therefore resigned, and Sir James Whitehead, I am sorry to say, since he joined the board, has been ordered by his medical adviser to go abroad for some time. Sir James worked very hard on the board while he was in London, but owing to the advice of his medical adviser, and knowing that at this period of the existence of the company it is absolutely necessary for the directors to give their attention to it, he has sent in his resignation, which, I need hardly say, has been accepted with very great regret by the board. We, of course, shall not be in a hurry to elect fresh directors, but we shall take our time to select gentlemen who will be able to give time to the board, and will also be able to give it the benefit of their experience. I do not know that there is anything more that it is in my power to say at the present time, except to assure you that the prospects of the corporation are very good indeed, and I hope and trust that in a year's time we shall be able to appear before you with a satisfactory account of the proceedings of the company.

The shareholders listened with commendable patience to the noble chairman, but immediately he sat down there was a hurried movement amongst certain turbulent spirits present to commence "heckling" him.

A Mr. Grantham had the first innings. He wanted to know the number of shares actually allotted.

"Twenty thousand shares," replied his lordship, "equal to a capital of £200,000."

"Absurdly insufficient," said Mr. Grantham, amid a chorus of "Hear, hears."

Then several indignant folk wanted to know why Sir James Whitehead and Mr. Sampson Lloyd had resigned, and if up to the time of their resignation they had been in accord with the rest of the board.

Lord Stalbridge said they had, but some incredulous shareholders appeared to doubt it.

Then followed a rough-and-tumble conversation, during which Messrs. Grantham, Foreman, Snare, and Unwin kept bobbing up and down like so many jacks-in-a-box. Lord Stalbridge kept his temper admirably; not to some of his tormentors, who indignantly asserted that had they known that the company would have gone to

allotment on so small a subscription they would unhesitatingly have withdrawn their applications for shares.

Some, in fact, went so far as to request the chairman to call a general meeting, in order to see whether, under the circumstances, it was desirable to go on with the company; others stated they would be content with getting back a portion of the money they had paid, for they were convinced that if the company went on not only would they lose all they had put into the concern, but that they would, in all probability, be liable to a further call.

The chairman asserted that, in the opinion of the board, there was no necessity for making a further call; but several shareholders impolitely asserted that this was all fudge.

Pressed to call the meeting asked for, the chairman firmly declined to do anything of the kind. He said there was no necessity for calling such a meeting, as he and those associated with him had every confidence in the future of the undertaking.

Frankly, I think "it goes without saying" writes the editor of the *Mirror* "that many people put their money into the General Phosphate Corporation on the strength of the magnificent list of founders, whose names are paraded big in the papers and in the prospectus. The list of founders is, we are assured, the same as when the company was floated; if they, then, have confidence in the concern, there should be no difficulty whatever in filling the places of the directors who have resigned from out of their number. Until this is done, and men as good as Mr. Simpson Lloyd and Sir James Whitehead have been elected on the board, the shareholders have every right to feel uneasy. It would be interesting to know whether the high opinions formed of the prospects of this company are shared by the founders; in any case, it will be equally interesting to know what induced them to become founders. If things do not turn out as Lord Stalbridge fondly anticipates, a very serious responsibility will rest upon these gentlemen. I shall be glad to insert any communication they may have to make upon the subject."

Asbestos Rivals.

(Trade, Finance and Recreation.)

Those companies which own asbestos mines in Canada swear that Canadian asbestos is the best that can be got, while those having mines in Italy say that all other is rubbish, but we may take it as a fact that Canadian is quite good enough for ordinary purposes. At all events, this is the conclusion we arrive at when we see, of the two companies which we are quite prepared to admit, in the absence of evidence to the contrary, do the greater part of the English business, that one which openly professes to use nothing but Canadian can give its shareholders dividends at the rate of 22½ per cent., while the other has so far been unable to pay interest owing on that half of its capital appropriated to preference shares.

The United Asbestos Company has a capital of £50,000 in ordinary shares, and £9,970 10 per cent. preference shares, yet after providing for the interest on the debentures, the trade profits do not yield enough to be worth dividing even amongst the preference shareholders, while the Bell's Asbestos has £100,000 in ordinary shares, which for last year received 22½ per cent., after interest on £68,400 debentures had been provided for. If these figures mean anything at all, they would prove that Canadian asbestos is not only good enough for ordinary purposes, but is infinitely the more profitable of the two kinds to manufacture. We have seen the different kinds, and would, if we were in the habit of wearing asbestos garments, prefer to have them made of the Italian material; but so far as we can gather, this kind of the stuff is an *article de luxe*, and too expensive for ordinary use. The accounts rendered by the two companies are too meagre to enable us to form any idea of what one or the other is doing, as we have no trading accounts, therefore we cannot get at what the turnover actually is, and this, after all, is what we desire to know. There is, besides, another item to take into consideration, especially as regards the Bell Company, and that is how much of the profit is derived from the sales of asbestos, raw and manufactured, and how much from lubricating oil, engineers' stores, etc., etc., in which this company does a large business. We understand that the United Company has recently given a good deal of its attention to this branch of business, yet we cannot but fancy that there is something wanting, some life and go which is absent in the one case and is conspicuous in the other—for with a very long start in business, and one half of the capital to provide for, the United would seem to have fallen hopeless by the roadside.

We noticed but a short time ago a letter from the general manager and secretary of the last named company, which apart from a certain amount of historical information, stated that the company's business had increased more than 20 per cent. over that of the previous year, that the increase in the first six months of

this year was nearly 25 per cent., and in the months of July and August the increase was over 35 per cent. This, we hope, is not altogether an imaginary or delusive increase, that is to say, an increase in the quantity of goods sold, without any corresponding increase in the profits; because we cannot get rid of the idea that we have heard somewhat similar words before. Still, as regards the benefit of this increased work to the shareholder, the result was practically *nil*. In fact, we turn back to the company's report for the year 1888, issued on February 20th, 1889, and find the following words:—"An encouraging feature of the business is, that while the sales of the first nine months of the year showed an increase of over 20 per cent. compared with those of the previous year, the sales of the last three months showed an increase of 35 per cent." Here we have almost word for word and figure for figure what is again repeated 18 months afterwards, the shareholders, preference and ordinary alike, still being innocent of dividends.

Turning now to Bell's report for 1888, we find the following paragraph:—"The large growth of the business during the past year has been continuous, the trade in each month showing an increase on that of the corresponding month of the preceding year"; and again, the report for 1889 says, "during the past year the home trade has grown in bulk, but the margin of profit has been less than was obtained in the preceding year"; and, in fact, the same dividend of 22½ per cent. was maintained.

Of the relative merits of Canadian or Italian asbestos, we confess that we know little; in our narrow-minded way we are compelled to judge by results, and we see that Canadian gives its shareholders 22½ per cent., and Italian nothing. There are probably other things to take into consideration, for even the United, which boasts so much of its superior Italian article, owns Canadian mines, so that it ought to be able to meet Bell's on its own merits in this quarter; therefore we are compelled to come to the conclusion that it is not to Canada or to Italy that the palm is to be given, but rather that results largely depend upon the way each company is managed.

The Ventilation of the Saarbrücken Collieries.

R. Nasse states that, of the twenty-four collieries in the Saarbrücken mining district, bituminous coal is mined at eight, the remainder working gas and non-coking coals. The total quantity of coal raised in 1884, to which year this report refers, amounted to 6,087,126 tons. The number of men working in the collieries with forced ventilation was 13,168. One-fourth of these worked with open lights, the remainder using safety-lamps. In all the larger collieries there are several independent ventilation sections, each of which has a special ventilating shaft, besides which they have usually several openings at the surface for the intake of fresh air. The mean greatest length of the air-ways is 3.26 miles, the minimum being 1.2, and the maximum 6.1 miles. Guibal's *temperament* (the ratio of the volume of the air-current, in cubic metres per second, to the square-root of the depression in millimetres of water) was determined in 24 cases; 14 times it was between 2 and 4, 7 times greater than 4, and thrice below 2; the minimum 0.9 occurring with an underground engine and boilers. The relative degree of moisture of the air-current reaches nearly everywhere, and usually at a very short distance from the intake shafts, 95 to 100 per cent. The latest analysis of the return air, made on behalf of the Russian Commission on Fire-Damp, showed it to contain from 0.203 to 0.652 per cent. of carbonic anhydride, as compared with 0.04 per cent. in fresh air; the percentage of hydrocarbons was from 0.473 to 1.463. At the time at which the samples were taken the air-current was at the rate of 69.22 cubic feet for every miner underground, one horse counting as four men. The temperature of the return-air in the main air-way proved in the Gerhard Colliery to be 25° C., a temperature exceeding by 6.5° C. the highest normal rock temperature of the strata occurring in the colliery. At the Camphausen Colliery, which is the most difficult one to ventilate, the return-air proved to be of a temperature varying from 27.5° to 29° C., the ventilation having lowered the temperature by 4° C.

At the end of 1884 only two of the collieries had natural draught; in one of these the air in the return-shaft was heated by a steam-pipe. In the collieries with forced draught there were 17 ventilating furnaces and 29 centrifugal ventilators. The furnaces produced air-currents with a mean volume of 352,212 cubic feet per minute, and the centrifugal ventilators a current with a volume of 979,082 cubic feet per minute.

Of the 29 ventilators, 26 are of the Guibal type, 2 of the Pelzer type, and 1 of the Zimmermann type. Up to the year 1877 the Guibal fans were all built from the same model, having a diameter of 23 feet, by a breadth of 6½ feet. At the present time the Guibal fans are constructed with a diameter of from 26 to 33 feet, the breadth varying up to 10 feet.

The volume of air allowed in the different collieries per man per shift is, in the mean, 85.8 cubic feet, the

minimum quantity being 25.42 cubic feet, and the maximum 298.7 cubic feet; this is at the mean rate of 71.69 cubic feet per ton of coal raised during the shift, the minimum rate for this quantity being 15.18 cubic feet, the maximum 265.5 cubic feet. The rate at which the return-air passes up the up-cast shaft reaches 16 to 23 feet per second. The ventilating furnaces are of small size, and burn in the mean 45.5 tons in the twenty-four hours. For 1,000 cubic metres of draught there are burnt by the furnaces 456 tons of coal, and for an equal rate there are used in working the fans 2.12 tons of coal. The annual cost of ventilation, at the rate of 1,000 cubic metres of air per minute, was:—

Furnaces.....	£401
Fans	432

The coal in the case of the furnaces being calculated at cost price, and with the fans at selling price. For the year 1883 the average cost of production of an air-current per ton of coal was a little more than one-half penny. Zinc pipes are used almost without exception for transmitting the air; they have usually a diameter of 10.23 inches. If the diameter is not sufficient two lines of piping are employed. The cost of such piping, together with the wages for placing in position, is, in the mean, four shillings per yard.

For dividing the air-currents sliding doors are employed. Brattices of indiarubber or of sailcloth are temporarily used; the indiarubber wearing best. For permanent use, masonry is employed. Wooden brattices are less frequently in use, as they are difficult to keep airtight. The cost of the brattice, including the wages expended while placing it in position is, per square metre:—

Sailcloth.....	from 1s. 6d. to 2s. 6d.
Indiarubber.....	2s. 6d. to 2s. 6d.
Wood.....	2s. 6d. to 2s. 6d.
Brickwork.....	3s. 6d. to 4s. 6d.

The German Government and the Miners.—It is officially announced that all, or nearly all, the demands which were recently submitted to the German Government by the miners' delegates have been conceded. The principal points are that shifts last eight hours only, that all the miners who were dismissed after the recent strikes shall be reinstated, and that provision shall be made in the Labour Amendment Bill, now before the Reichstag, for the creation of arbitration courts. The mining officials also are to come under the jurisdiction of the court of discipline, and they are to be punished for ill-treating miners. "Farming" certain jobs is also to be abolished.

Comparison of Electricity and Compressed Air.—Mr. H. W. Hughes (South Staffordshire Institute of Mining, Eng., vol. xv., pp. 69-82), has collected details of cost and efficiency of electric transmission of power, and compares them with the cost of pneumatic transmission. At the Chapin Mine in Michigan, air is compressed to 60 lbs. pressure at 60° F. by four turbines, and is conveyed through a 24 inch pipe for three miles. The pipe cost £12,000, and the total cost of the plant is estimated at £100,000. A test showed 1430 indicated horse-power at the compressors, and the sum of the indicated horse-power at the mines was only 390; the loss is therefore nearly 73 per cent., and this amount does not include friction of the compressors. The author gives a second case, in which a 500 horse-power turbine compressed air and delivered it three miles distant. The efficiency was 32 per cent. and the cost of the plant £84,000. An electrical company has agreed to give an efficiency of 60 per cent. from a similar turbine for a cost of £17,520, inclusive of the entire electrical equipment.

Arbitration in Labor Disputes in the United States.—Referring to the decrease in labour disturbances in the United States during the past year, the British Consul-General in New York in his last report says that this favourable change is attributable largely to causes—first, to the general acceptance of arbitration in one form or another, as enforcing the true principle of settlement of disputes, especially in productive industries, where the interests of capital and labour are mutual; and, secondly, to the power of investigation vested in the Board of Mediation, which has had the effect of deterring parties from making undue exactions and imposing unjust conditions. The Board in its report to the Legislature, states that its constant effort has been, through a wide distribution of its reports among those whom they may concern and by other available means, to impress the lesson of arbitration and infuse a spirit of compromise, and to induce settlements by local boards, or by direct negotiations between the parties, free from outside intervention. The tendency and growth in this direction have been encouraging. The destructive policy of a "a word and a blow, but the blow first," is gradually being reversed, and the blow of a strike or lock-out is coming to be regarded in order only as a last resort after the word of reason has proved a failure.

The Canadian Mining Review

CONDUCTED BY . . . B. T. A. BELL

OFFICES:

UNION CHAMBERS, 14 METCALFE ST.,
OTTAWA.

Vol. IX. OCTOBER, 1890. No. 10

Visit of the Iron and Steel Institute to Canada.

A party of the members of the Iron and Steel Institute of Great Britain and German Association of Iron Smelters, numbering nearly one hundred ladies and gentlemen, have accepted the invitation of the Federal and Ontario Governments to visit the Dominion. The party will enter Canada at Niagara Falls, where they will be met by Dr. Selwyn, Director of the Geological Survey of Canada, and Mr. B. T. A. Bell, Editor of THE CANADIAN MINING REVIEW, who are entrusted with the arrangements on behalf of the Dominion Government. After a visit to the Falls the party will enter a special train on the morning of the 29th and leave for Toronto via Hamilton. The following is a brief outline of the programme prepared for the reception and entertainment of the distinguished visitors:—

OCTOBER 29TH—WEDNESDAY.

Reception at Toronto. Drive to Public Buildings. Banquet given by Board of Trade in evening. Leave Toronto *via* Grand Trunk Railway Special Train for Sudbury at 11 p.m.

OCTOBER 30TH—THURSDAY.

Visit Mines and Works of Canadian Copper Company, H. H. Vivian & Co., and Dominion Mineral Company. Leave per Special Train for Ottawa at six p.m.

OCTOBER 31ST—FRIDAY.

Arrive in Ottawa noon. Reception by Cabinet Ministers. Drive to Lumber Mills, Chaudiere Falls, Pulp and Match Factories, Parliament and other Public Buildings, etc. Attend "At Home" given by citizens in Russell House. Hotel Headquarters, Russell House.

NOVEMBER 1ST.

FORENOON—Visit Geological Survey Museum and Offices. Luncheon given by the Federal Government, to be presided over by His Excellency the Governor General. Leave per Canada Atlantic R'y for Montreal at five o'clock p.m. Arrive in Montreal 8.15. Hotel headquarters, Windsor.

NOVEMBER 2ND—SUNDAY.

NOVEMBER 3RD—MONDAY.

Party will leave per Train in morning for Lachine where they will Shoot the Rapids and return in time for Luncheon. Drive in afternoon to Mount Royal, Public Buildings, Redpath Museum, McGill University, etc. Reception in evening.

NOVEMBER 4TH—TUESDAY.

Programme under consideration.

It is greatly to be regretted that owing to the hurried nature of the visit and the necessarily limited time at the disposal of the visitors, but little opportunity will be afforded them of inspecting our mines and quarries. The invitation was very hastily issued, and at a date that precluded any possibility of an extended visit to

our mining centres. It is hoped, however, that sufficient will be seen of the country to impress them with the extent of its resources, its marked prosperity, and the opportunities and advantages it offers as a field for industrial development and the investment of capital. We extend to the Institute and the German Association of Iron Smelters a hearty welcome to the Dominion, and wish them one and all a pleasant and enjoyable excursion.

Evils Inherent to a Pernicious System of Company Promoting.

During the past year our phosphate districts have been excited by rumours of a great "Trust" in England that intended to buy up vast quantities of phosphate land. A few properties were bonded by visitors from London and by influential Canadians who forthwith visited England "purely for pleasure." A preliminary prospectus was issued, having among its directors the names of the "Marquis of Exeter" and "Sir Charles Tupper, by special permission of the Government." By means of this distinguished support a great array of nobilities was displayed on the List of Founders in the final prospectus, though the name of Sir Charles Tupper had disappeared, possibly in consequence of the fiasco of the Three Rivers Meat Company. The General Phosphate Corporation, with a nominal capital of £1,000,000, offered its shares to the public, who responded so poorly that, notwithstanding the assurance from Lord Stalbridge that 20,000 shares, equal to £200,000, had been allotted, but comparatively small amount of cash was secured, and it became necessary to call upon the Founders, or underwriters, to take up the shares to the extent that they had pledged. It is understood that there has been some demur in responding to these calls, and in many quarters doubts as to the strong financial condition of the company are freely expressed.

We are pleased, however, to note that the Corporation has really purchased the Stewart Lots at the High Falls, the Ross mountain property, also on the Lievres River, and the Murphy Lots in Templeton, provisional to certain conditions agreed to by the vendors. Mr. George Stewart, the vendor of the High Falls property, has contracted to take out a stipulated annual output, and mining operations will be begun forthwith. Mr. Stewart is well known to be a shrewd and practical manager, and we sincerely wish him and the Corporation every success. Our allusion to the circumstances attending the organization of the company is not made in any unfriendly spirit, but rather for the purpose of calling attention to some inherent evils that this and similar undertakings inflict upon the phosphate and other sections of our mining industry. It may be fairly charged that the falling off of some 10,000 tons in the output of phosphate this year is due to the formation of the Corporation. A property that produced nearly 10,000

tons last year was bonded to the promoters of the Corporation, and, in confident expectation of a speedy sale, work was reduced, and the output for the year has been merely nominal. In the Perth district alone nearly 50,000 acres of land were bonded by speculators and offered to the Corporation. Assurances were given that the lands were accepted, and for six months past the visit of the inspector has been a matter of weekly expectation. Repeatedly pits were cleaned out and properties "fixed up" for the anticipated visit, and every little while the report has gone around the country that "the papers were to be signed in a few days." This kept the country in a ferment, and great will be the disappointment if after all the purchases are not made. With the exception of the work of Messrs. Wilson & Green at Black Lake, and the Anglo-Canadian Phosphate Co. at Otty Lake and Bob's Lake, there has been no legitimate mining of any moment done in the whole of this district for a year. A large fortune quickly won by a land sale was a more pleasing prospect than the smaller and slower gains of mining. One property, purchased for \$7,000 by a man of large means, was opened up and held in idleness at an asking price of \$100,000, although the owner could have more than doubled his money in a year by taking out the phosphate already exposed and reasonably assured.

This is the first evil to which we would allude,—the promotion of land speculation and the consequent discouragement of genuine mining operations by the formation of these great "syndicates."

The second evil of such corporations is the limited chance of success that they stand, owing to the heavy expenses with which they are burdened. In this case £10,000 was estimated for promotion expenses. The cost of English visitors and "distinguished experts" has to be met and an "eminent London solicitor" is sent across the ocean to examine titles, which, owing to our simple system of registration of deeds, could be accurately determined by any intelligent lawyer's clerk in the country. The fees of directors are an extra expense, and the salaries of managers and assistants are apt to be larger and more numerous than in private undertakings. The enterprise is thus handicapped from the start with a dead outlay of capital, in addition to the large amount invested in the lands; and here we may remark that the Canadian seller receives only a moderate compensation as a rule, but his asking price for the land is doubled or increased many-fold in the prospectus, the difference going into the pockets of the company promoters or in paying the heavy cost of floating the company. The outcry against high prices of land in Canada is made by men who would think nothing of offering it to the British public for three times the sum, and if any such prices are available we would like to see the money paid out principally in Canada to the men who have developed the properties.

It may as well be frankly stated that past

experience shows that phosphate mining affords a good prospect of a fair commercial gain, but offers a small chance of a great speculative profit. The well-selected property, managed and worked with close economy, will, at present market prices for phosphate, give a return that will be satisfactory to the reasonable investor. But a public company, promoted at great cost, saddled with honorary expenses, obtaining lands at inflated values, and carrying on its work in an extravagant or ill-considered fashion, has a small chance of success.

We would, therefore, urge Canadians to work their lands themselves. They can usually obtain additional working capital at home or abroad in return for a share in their enterprises; and they should be content to accept aid on these terms and look to their legitimate earnings for their reward.

For a year and a half there has been a "phosphate boom" in London, but it has been overwhelmed by the discovery that "all the phosphate land in Canada was for sale." Now Florida phosphates have diverted the attention of speculators, and it may as well be understood that the Canadian boom has burst; and we must add that it has done but little good and a great deal of harm. Let Canadians go to work and do an honest mining business instead of trying to unload their lands upon foreign "syndicates." Then they will have buyers coming to them to purchase their productive mines, and they will in the end have more profit, greater self-respect, and a better reputation than have been gained by the late fruitless efforts to dispose of indefinite mining "prospects" for definite cash.

Profit Sharing at English Ironworks.

On Saturday morning the result was made known of the ballot taken the previous evening, of the workmen employed by the Thames Ironworks & Shipbuilding Co., limited, on the question of the adoption of the proposed scheme for profit sharing submitted to the men by Mr. H. F. Hills, the managing director.

The objects of the scheme were set forth—(1) to unite the interests of all concerned in the works, and to provide that the workmen shall participate in the prosperity of the company; (2) to prevent the friction, waste, and consequent loss from antagonistic views as to the relative claims of capital and labor under varying conditions of trade; (3) to emphasize the fact that in the Thames Ironworks it is in the power of workmen by individual exertions so to improve the work and economise the cost of labor as to enable the company to give them a share of the profits. The conditions were that after receiving £23,750 per annum as interest upon the shareholders' existing capital, the remainder of the profits should each year be equally divided between the company and their employees. Arrangements were made for the keeping of accounts to and for the election of a representative council of sixteen—eight by the company and eight by the workmen of the different trades. Men after six months were to be entitled to participate in the division of profit; the proportion earned by those not in the service six months was to be and form the basis of a provident fund to be administered for the men in a manner agreed upon. It was to be understood that the adoption of the scheme (outside the conditions) would leave the company and the men entire freedom in other respects, and the scheme was to be determined at twelve months' notice on either side. It was first published in April last soon after a strike of joiners at the yard, and was, when put to the vote, emphatically rejected. But the minority of the men, dissatisfied at the result, called the whole workmen together, and negotiations were apparently settled satisfactorily—the six months' service was altered to three months, and six months were fixed upon as the determining period—and the men, having taken the counsel of

various trades unionists, co-operative and socialistic leaders, it was hoped that the next poll of the men would decide to adopt the scheme, a great point being that when it was adopted the definite rules would be formulated by the representative committee, and be submitted to the directors. The poll was by ballot this time, and when the figures were announced they surprised even the more sanguine of the opponents of the scheme. For adoption 507 voted, against 1,206; 107 were neutral, and 15 ballot papers were spoilt. The votes were counted in the presence of the representatives of the men and the company.—*London Iron and Steel Trades Journal*.

LETTERS TO THE EDITOR.

The New Phosphate District.

TORONTO, October 13th, 1890.

The Editor:

SIR,—My attention has been called to an article in your issue of last month as to a new phosphate district which has been discovered about fifty miles north-west of Peterborough, and which has been visited by Mr. William Watt of Perth. Doubtless this is the district which our company has lately been operating in as we understand Mr. Watt lately visited it, and as it is important that this new district should not be injured at the start by such unreliable information as you appear to have received about it, I am instructed to send you a short report that was made to us some time ago by a gentleman who visited the district but who is wholly unconnected with this company.

We would be glad if you would help to remove the false impression that your article may have left with the public regarding this district by publishing this report in the next issue of the CANADIAN MINING REVIEW.

The name of the gentleman who made the report can be furnished to you at any time if you so desire it.

Yours, etc.,

J. S. LOCKIE,
Secretary Haliburton Mining Co., Ltd.

REPORT REFERRED TO:

Classification of mines in the Townships of Monmouth and Dudley, in the County of Haliburton, lately opened up by the Haliburton Mining Company, Ltd.

NO. 1 UPPER, LOT 15, CON. 11.

Cutting 10 ft. deep and about 40 ft. long. Large deposits of phosphate, calcine and mica. (Large sample red and green phosphate.) Lots of rock phosphate thrown out which could be cobbled.

NO. 2 UPPER, LOT 16, CON. 11.

Fine, clean red rock phosphate at the top; also red and green in the workings.

NO. 3 UPPER, LOT 17, CON. 12.

Vein crossing north-east and south-west; width about 20 feet. Very large masses of red rock phosphate; also plenty of mica.

NO. 2, SAME LOT, CON. 3.

500 yards from No. 1; also very fine deposit of red and green phosphates. Phosphate abounding on the surface. Natural drainage from the shaft.

NO. 4, LOT 17, CON. 12.

Just uncovered; same appearance or indication as Nos. 1 and 2. Slightly lower down the hill, with very fine deposit of rock phosphate, equal to any of the others.

NO. 1 LOWER, LOT 15, CON. 11.

Very fine deposits of green and red rock phosphate. On the cobbled or waste rock from 10 to 20 per cent. of phosphate adhering to it is absolutely wasted from want of proper machinery for dressing the same, and this applies to all the other deposits mentioned. This pit is about 14 ft. surface. (A very large specimen weighing two or three hundred pounds.) At this time there is ten to twelve tons of clean phosphate ready to ship.

NO. 2, LOWER, LOT 14.

Very large bed of red and green phosphate very near the surface; the pit is about 11 feet deep, phosphate showing at both ends, three feet solid at one of the ends and pretty near the same at the other. About three tons cobbled; enough to make a carload on surface uncobbled.

NO. 3 LOWER, LOT 13.

Eastern boundary. A very great depth of gray and red rock phosphate. Rock coming between the two beds of phosphate. This looks promising.

DUDLEY MINE.

Crystal and rock phosphate on the surface, also in the pit and lots of mica. This phosphate is also of the highest quality, and being only just opened a large vein can be traced to great advantage, but it is anticipated the vein can be approached under more favourable circumstances.

All of the above phosphates are of the very highest grade. An analysis made by Professor Chapman of Toronto University of some of this phosphate shows it to be equivalent to tribasic phosphate of lime 88.89 per cent.

[We cheerfully publish the above and hope that the expectations concerning the new phosphate district will be realized. The best proof of its value would be the production of ore. Our previous informant—a gentleman who, by the way, is fair, unbiassed and thoroughly practical—stated that as the result of three or four months' work on one property he saw one ton of clean phosphate and ten tons of uncobbled rock. The report given above mentions an output of 10 to 12 tons from one pit, and three from another, with a car load to be cobbled. This is the kind of evidence wanted, and not mineralogist's statements of "very large masses," "very fine deposit," "phosphate abounding," "very large bed," "a very great depth of phosphate," etc. A property that answers to this description might soon speak for itself and needs no puffing by experts. We speak in another column concerning the evil tendency to fix up properties for sale instead of working them productively.—ED.]

The Duty on Mining Machinery.

OTTAWA, 24th Sept., 1890.

The Editor:

MY DEAR SIR,—Mr. Tupper desires me to acknowledge your letter of the 19th inst., and to say that he has asked the Commissioner of Customs for a full report on the subject of your communication.

Mr. Tupper will lay this report before the Privy Council if Mr. Bowell has not returned when the report is ready.

Yours very truly,

C. C. CHIPMAN.

OTTAWA, 20th October, 1890.

The Editor:

DEAR SIR,—Replying to your letter of the 17th inst., I beg to say that I have placed your application with reference to the duties on silvered-copper plates for gold mill amalgamators before the Minister of Customs who has, as you are aware, returned to Ottawa since your previous communication upon the same subject.

Yours faithfully,

CHARLES H. TUPPER.

Tests to be Applied to Slate.—Prospectors looking for slate quarrying locations are often at a loss to know when they really have a good slate. The few following simple rules, familiar to those in the trade, will enable them to distinguish a bad slate from a good one, with sufficient certainty to be useful:—

(1.) As a rule, good slate when struck gives a clear, bell-like sound.

(2.) It is generally considered a good sign when it shatters more or less before the edge of an axe.

(3.) Light blue slate is less absorbent, as a rule, than black blue varieties.

(4.) Good slate has a hard, rough feel, while an absorbent slate feels smooth and greasy.

(5.) The absorptive powers of a slate may be tested in two ways. 1. Place the slate on edge half immersed in water. If it draws up the water and becomes wet at the top in six or eight hours, it is spongy and bad. The extent to which the water ascends is roughly the measure of absorption. 2. Weigh a piece of the slate dry and then again after immersion in the water for twelve hours, after wiping off the superficial moisture; if it shows much increase in weight it is too absorptive to be good.

Our Portrait Gallery.

[A series of portraits and biographical sketches of Canadian mining engineers, mine managers, inspectors, geologists, explorers etc.]

No. 6.

Capt. Thomas H. Tretheway, Port Arthur, Ont.

The subject of our sketch was born in St. Stevens' Parish, Cornwall, England, on the 22nd day of December, 1841. He is the eldest son of James Tretheway, the miner, of the same place, and is a living exemplification of what integrity, perseverance and intelligence faithfully applied, will do for any man who marks out for himself a course, the beacon star of which is to render the most faithful and honest service in his power to his employers, no matter in what capacity he may serve. He is closely identified with the progress and advancement of the district of Algoma, both by land and water, having served the early settlers on both elements, through many years of its early history, and the name "Capt. Tom" is familiar in every household from Thunder Bay, on Lake Superior, to the Bruce Mines on Lake Huron. He has not always confined his attention to mining, having at different periods in his history been a master of construction on public works, such as breakwaters, docks, etc. He followed a seafaring life during several summers on the Great Lakes, rising steadily, from "before the mast," to be master of several different steam and sailing vessels. At present he holds a master's certificate, entitling him to take command of any passenger or freight-carrying vessel, steam or sail, plying on the great inland waters. He also holds a certificate as a third-class marine engineer. So that it may readily be seen that no matter what the nature of the employment might be his one object was to excel and thereby gain the top rung of the ladder. With regard to his connection with mining it need only be said, that from sorting ore, up to being superintendent, he always gave eminent satisfaction. He has three sons growing up perfect imitations of their father. The eldest is 23 years of age, and is a competent assayer. He had charge of all machinery, including the repairing of drills and pumps underground, and the erection of two hoisting engines, one compressor and four steam pumps at the Shuniah Weachu mines. He improved the pumps so that they condensed their own steam, by turning the exhaust steam into the suction pipe of the pump, thereby increasing the power of the pumps from 10 to 20 per cent. and saving the company a proportionate amount. An incident in the early life of Capt. Tretheway well illustrates the character of the man. He was employed doing some work for his father, and was chided by him, in the old Cornish fashion, "that

he would never be as good a man as his father." He answered "yes I shall, and a better, and some day have charge of all your other sons." Four years after this he was in charge of The Roberts Coal Mine, at Salineville, Ohio, at which time his father and brothers were employed under him.

The subject of our sketch emigrated to Canada in company with his parents. The family landed in Quebec in the summer of 1848, and proceeded westward by river and lake, and settled at Port Hope, Ont. His father was given charge of the Grand Trunk Railway Company's quarries between Cobourg and Toronto. During his residence in Port Hope our subject enjoyed the only schooling it was his privilege to receive during life, and then only for a period of about two years, for as soon as he was able,



like many others of Canada's sons in those early days, he was, from force of circumstances, compelled to labor for his daily bread. He continued to work in and about the quarries until the summer of 1858, when the family again joined the stream of emigration flowing westward through Canada, and settled at Bruce mines, Algoma.

He was then 17 years of age and went to work in the jigging houses of the West Canada Mining Company, of which the late Wm. Plummer, M.E., was then Superintendent, and James Bennets, Manager. The company operated the Wellington and Huron Copper Bay properties, which were adjacent to and a continuation of the veins of the old Bruce Mines, which were operated by the Montreal Mining Company. This group of mines may be said to have been

the cradle of the mining industry in Western Canada, and in it our young friend was nurtured up to the years of early manhood. In 1850, Capt. Richard Wallis, of the North-West Mine, Keewenan County, Mich., engaged him to go to the then northern wilds of Michigan, on the south shore of Lake Superior, where he worked as a miner, timberman and shaft foreman for a period of two years. Later, under the superintendence of S. W. Hill, he was employed by the same company as an explorer, on the property which is now known as the Delaware and Pennsylvania Mine. He was thus employed for two years, when he returned to the Bruce Mines, and worked as a tributer at the Bruce, Wellington and Copper Bay mines. In 1863 he removed to Woodville, near Jackson Mich., and entered the employ of the Woodville Coal Mining Company as a coal miner, and in that capacity advanced very rapidly to a front rank. He was then engaged by Roberts & Co., coal miners of Cleveland, Ohio, to take charge of their works and open up their coal properties at Salineville, Columbiana Co., Ohio. He performed this work in the most satisfactory manner. In addition to opening the mine, it included the building of half a mile of railway and three-quarters of a mile of tram-road. He once more turned his steps towards Bruce Mines and entered the employ of the West Canada Mining Company as manager of the jigging houses. His somewhat restless disposition induced him to adopt a seafaring life on the lakes during the summers, where he evinced the same aptitude that he already had at mining, exploring and works of construction. By his energy and economy he soon became the owner of vessel property. He was master and owner of the schooner *Warner* and other vessels well known to the older residents of Algoma, trading on Lakes Huron, Superior and Georgian Bay. In 1871 he was sent to Thunder Bay, now Port Arthur, by Thomas Marks & Bro. to superintend the construction of

two stores, a dock and warehouse. In 1873 he was given charge of a portion of the work on the Government dock, then under construction. He was then employed as a master dock builder and had charge of the erection of machinery at the famous "3A" mine, and at Jarvis Island Mine, in each of which cases he received a considerable bonus for the satisfactory way in which he performed the work. He again took to sailing, and was master of the steamers *A. Neff*, *Watchman* and *Kate Marks*. In 1880 he entered the employ of the Silver Islet Consolidated Mining and Land Company, first at rebuilding the tugs and scows used in transporting the ore from the islet to the mill on the mainland. He was then given charge of the construction of 200 feet of breakwater at the most exposed part of Silver Islet. This piece of work still

stands, and is apparently as good as when constructed. At this time he was promoted to the position of underground captain, and had charge of all underground work, including the sinking of the new shaft from the surface down to the ninth level. During this period he had charge of the construction at this mine of the first skip road ever built on the North Shore of Lake Superior. In 1882 he was given the superintendency of the company's works at Cape Maimase, Lake Superior. He remained there till the company closed its operations.

He then entered the employ of D. McDonald & Co. at Port Arthur, and was given charge of construction on the Port Arthur breakwater, and sank the first twenty cribs. He was then employed by George H. Macdonnell, of the same firm, to open up a Baryta mine on McKellar's Island. Work was suspended there in the fall of 1886, and on the formation of the Shuniah Weachu Mines Company, of Liverpool, Eng., he was engaged by them as underground captain at their mine at Silver Mountain. In the following year he was promoted to the superintendency of the company's entire works, and remained as such up to the 15th May, 1890. While employed here he did all the assaying for the mine. On his retirement he was presented with a cash bonus and testimonials from the company, couched in the warmest terms of appreciation.

During his superintendence at this mine he was frequently engaged by owners of mining properties to examine and report upon them as to the advisability of development, etc., and although he received such a limited education in his youth, his reports are second to none, and will compare favourably with those of men with half the alphabet after their names.

On the first day of June of this year he again entered the employ of the Silver Islet Consolidated Mining and Land Company as superintendent of the company's works, including Silver Islet, Edward's Islet, Cape Gargantua and Cape Maimase, all of which properties are again being opened by the company.

The Opening Meeting of the Iron and Steel Institute.

The first day's session of the British Iron and Steel Institute opened at New York on October 1st, in Chickering hall. The attendance was very large. The foreign delegates predominated in numbers, but quite a number of the American Institute of Mining Engineers were present. Sir James Kittson, President of the B. I. and S. Institute, was in the chair, and called the meeting to order.

Mr. ANDREW CARNEGIE delivered an address of welcome, to which Sir James responded.

Gen. SHERMAN received quite an ovation as he was being escorted to a seat on the platform.

Sir JAMES KITTSO then said it was intended to present a diploma of membership and a gold medal to the Hon. A. S. Hewitt, but he was not present owing to illness, so the presentation was not made.

Mr. HEWITT's speech was then given out to those present in printed form.

The first paper read was "The Development of American Blast Furnaces," by Jas. Gayly, of Bessemer, Pa.

Sir LOWTHIAN BELL then read a paper treating on the effect of more or less carbonic acid in furnaces.

INVITATION TO VISIT ONTARIO.

Sir JAMES KITTSO then introduced Mr. Archibald

Blue, the chief of the Statistical Department of Ontario, who addressed the Institute as follows:—

Sir James Kittson and gentlemen of the Iron and Steel Institute,—I have come at the instance of the Government of Ontario, whose officer and servant I am, to extend to you an invitation to visit that important Canadian commonwealth before you return home. Word has reached the Government that some of your number purpose passing through our country on their way down from the mining regions of Minnesota, Wisconsin and Michigan, and that a short stay is likely to be made at the nickel and copper mines of Sudbury. An earnest hope is entertained not only that they may be led to prolong their stay in Ontario and extend their visit to other mineral districts, but also that the whole body of the Institute may be prevailed to come and do likewise. It is recognized, I ought to say, that your Institute has come to America at this time at the generous invitation of the American Institute of Mining Engineers, and that you are here as the guests of that body. But on the membership roll of that association there are a goodly number of Canadians, one of its latest and best meetings has been in the capital city of the Dominion, its name embraces the continent, and it is international in aim as well as in name and complexion. Rather, it is cosmopolitan, as all science is, and therefore not cribbed or confined in the sphere of its interests by State or continental limitations. And so the Government which I have the honor to represent trusts and believes that it will not be regarded as an intruder when it sends cordial greeting to the members of the Iron and Steel Institute, and invites them to see Ontario and spy out some part of its mineral wealth before they have completed the American tour. It would be a pleasure to the Government to have an opportunity of showing civilities to the members of the Institute, representing as they do one of the greatest of the great industries of the Mother Land; and I am also authorized to state that in this agreeable undertaking the Government will be heartily joined by the Board of Trade of the city of Toronto, the strongest and most representative organization of the kind in Canada. You, gentlemen, are specially interested in iron and the supply of iron ores. You are now to a large extent dependent on foreign countries for the qualities of ores needed in the production of steel, and it may concern you to know that in Ontario we have immense ranges of iron ores, mostly of the magnetic variety, touched as yet only by the hammer of the prospector, and waiting for enterprise and capital to develop them and convert them into the best grades of iron and steel. You are expected to visit the famous Vermilion range in northern Minnesota, the annual output of whose mines has risen in five years from a few thousand to more than half a million tons. Well, sixty miles away, in the Province of Ontario, we have the same geological formation, and extensive ore bodies have recently been discovered there, while a hundred miles to the north-westward, midway between Lake Superior and Lake of the Woods, there is a mountain of rich magnetic ore, several miles in length, and claimed to be well suited for the production of Bessemer steel. We have also large bodies of clean magnetic ores in the eastern part of the Province, and others not so clean; but after the demonstration witnessed on this platform two days ago there is little fear, I think, but that the ingenuity of man will succeed in exorcising the evil. To the British ironmasters, some of the greatest of whom are here present, a brief statement of these facts may not be without interest or value even if they cannot all at this time be persuaded to come, and see, and know for themselves.

There is, however, another reason why the Government of Ontario and the Toronto Board of Trade desire that the Institute should accept an invitation. You have heard something of the existence of nickel ore in our province, and it is proposed, I understand, to spend a few hours at the mines and smelting works of the Canadian Copper Company of Cleveland, Ohio, the Hussey-Vivian Company of Wales, and the Dominion Mineral Company of Canada, all of which are in the vicinity of Sudbury. The experiments of Riley and Hall with nickel and steel are familiar to members of the Institute, for they were luminously presented by these gentlemen at your meeting of May last year. Since then, as I happen to know, these experiments have received the careful attention of one high in the counsels of the Government of the United States, and promptly following the tests upon armor plates made at the Annapolis navy yard a few days ago we saw nickel placed on the free list and a million dollars voted by Congress to purchase a supply of the metal, to be used in the manufacture of nickel steel for plating the new battle-ships. Here in the United States the impression appears to prevail that the ore exists in very limited quantities, and that unless it is at once secured a more favoured nation may get in ahead and take all. It is therefore pardonable in the members of the Iron and Steel Institute, living about 4,000 miles away, if they are no better informed than our neighbours on the extent of Ontario's resources in nickel ore. The fact is we do not know their exact extent ourselves. But we do know that great ranges of ore have been discovered over an area of several hundred square miles, and from

its occurrence in a particular formation we have reason to believe that it exists throughout a region several thousand square miles in extent, a vast portion of which is an unbroken wilderness, untrodden by the foot of man. It is never safe to prophesy unless you know, but I verily believe we have enough nickel ore in the Huronian rocks north of the Georgian Bay to plate the navies of the world for a thousand years, and to serve many other and better purposes besides,—assuming, of course, that the metal can be economically separated from its compounds, and there is barely a doubt that it can. No other colony of the British Empire is the equal of Ontario in agricultural capabilities, and in hewing farmsteads out of the woods, Britain's sons have done a great work there since 60 years ago. They came to us for the most part without other capital than stout hearts and willing hands, and in their chosen occupation they showed what British pluck and intellect have done in every calling of life, in every corner of the earth. We are making an effort at the present time to get more men of the same class, and we have room for many more. We have 200,000 square miles in Ontario, of which hardly the half has yet been occupied. What remains lies for the most part within the Laurentian, Huronian and Animikian belts, in which there are numerous occurrences of gold, silver, iron, nickel, copper and apatite, and hence more attractive to the miner and metallurgist than to the farmer. In nickel and iron ores it is especially rich, and we think that the time is opportune for the British ironmaster to seek to do there in his own industry what the British farmer and settler have so successfully done in agriculture. We are fellow-citizens with you, and where our institutions differ from those of the United Kingdom we believe they differ not for worse but for better. Sometimes we have thought that in your enterprises and investments you have shown greater partiality to the older son, Jonathon, than to the younger, Johnny Canuck. But we recognize the laws which govern business operations, and we do not doubt that success will come to those who work and wait for it, if they are worthy of it. We are living on excellent terms with Brother Jonathan, in spite of seeming rivalries at Ottawa and Washington in the building of tariff walls, and we have some of his capital and skill employed in utilizing our mineral wealth. But much more is needed, and if abounding deposits of iron and nickel ores are a temptation to the gentlemen of the Iron and Steel Institute, I know that I can give to them for the Government of the Province of Ontario and the Board of Trade of the city of Toronto the assurance of a kind and hearty welcome to the country of the great lakes.

AN INVITATION FROM THE DOMINION GOVERNMENT.

At the conclusion of Mr. Blue's remarks the institute was addressed by Dr. Selwyn, chief of the Geological Survey of Canada, who conveyed an invitation from the Dominion Government to the members to visit Ottawa and other portions of the Dominion.

Both invitations were most heartily received. Subsequently a conference was held by a large number of the delegates who desired to visit Canada with a number of Canadians present, consisting of Mr. Blue, Dr. Selwyn, Mr. Henry W. Darling, and Mr. Erastus Wiman. It was arranged that as the members of the institute would be compelled to adhere to a programme, the visit to Canada would have to be made after that of Washington. Under existing arrangements they will reach Sudbury Junction on the 23rd of October, Niagara Falls on the 24th (at which point they are to be entertained at luncheon by Mr. Wiman), then to Washington, where they are to be presented to the President. On the 26th and 27th they will return to New York, and from there go to Canada via Niagara Falls, say about the 29th or 30th of October. The number who have thus far expressed a determination to visit Ottawa is about one hundred. As they will not sail from New York until November 8th by the Etruria, they will have nearly a week to spend in Canada.

Annual Meeting of the Newfoundland Colonization and Mining Company (Limited).

The shareholders of this Company held their ordinary general meeting last month, at Winchester House, Old Broad Street, London, E.C., Mr. Charles Clark presiding.

The directors presented the following report:—"The directors herewith submit to the shareholders the accounts made up from the incorporation of the Company to June 30th, 1890. The directors, anticipating that the shareholders would like the latest information, have arranged that Mr. Wingfield Bonny, the general manager, shall attend the meeting, when he will give a detailed account of the present position and future prospects of the Company's operations in Newfoundland. It will be seen that the sum of £4,024 4s. 3d. has been spent in developing the La Manche lead mine, which has been vigorously pushed forward, and is now sufficiently opened up to enable the directors to consider the policy of selling the

mine, or of forming a subsidiary company to acquire their mining rights, in the shares of which they would retain a large interest, so that the shareholders of this Company might participate in eventual profits without further outlay of capital on their part. Owing to the unsettled state of the Western part of Newfoundland in connection with the fishery disputes, no work has been done on the Company's St. George's Bay grants, either in the way of prospecting or clearing land for colonisation; and the directors consider it would be undesirable to attempt this until the respective Governments have arrived at an amicable settlement of the matters in dispute. In accordance with the statement made in the circular of April 27th, 1889, Lord Thurlow accepted the chairmanship of the Company, but finding that he was unable to devote to it the amount of time which he felt it required, he subsequently retired from the board. He retains, however, his large stake in the concern, and continues to take a warm interest in the affairs of the Company. At the suggestion of a large number of shareholders in the West of England, Mr. W. W. Baker, of Bristol, was elected to a seat on the board. It will be necessary for the shareholders to appoint an auditor for the ensuing year; Mr. H. Cattley Stewart, who has audited the accounts for the past year, offers himself for election."

The Chairman, in moving the adoption of the report, after expressing regret at the retirement of Lord Thurlow from the board, said that in Mr. Bonny's report in November, 1888, £20,000 was mentioned as the estimate of the sum which ought to be raised in order to carry on operations satisfactorily, and that the directors gave them a promise that unless they saw their way to at least £10,000 they would not proceed to allotment. Having secured that minimum, and something more, to begin with, they were led to hope that a larger amount might gradually be obtained, and their best efforts had been put forth to obtain that. But, in common with many other companies which sought support from the public last year, they found that the desired additional capital was not forthcoming, and their total subscriptions up to the present time amounted to only £11,400. The shareholders would remember that in the same report Mr. Bonny called special attention to the La Manche lead mine as the enterprise offering the best prospects of early profit, and recommended that they should at once proceed to put it in such condition as would afford them the choice of either continuing to work it on their own account or selling it at a price which, in addition to recouping, might provide the capital required for their operations. That was the policy on which they had been acting, but they confessed that they were disappointed that they were not yet actually returning ore. The coal seams and the rock-salt upper crust could be generally developed as sufficient capital became available. Negotiations were in progress for leasing to a responsible firm in Nova Scotia the Company's timber-cutting right over 12,000 acres of forest land in the Gander Lake district on very advantageous terms. The board proposed to commence colonisation in the St. George's Bay district, but the unsettled state of matters in this region of the island through the fishery disputes had prevented any progress. The Chairman concluded by referring to the railways now in course of construction near the property of the Company.

Mr. W. H. Wilson seconded the motion.

Mr. Bonny (the general manager) having addressed the shareholders at some length with regard to the prospects of the Company, the report was adopted.

A Brave Miner.

Few pleasanter tasks fall to the lot of the journalist, says the *Pall Mall Gazette*, than that of recording those acts of heroism and self-sacrifice which from time to time brighten the most commonplace toil. There is not just now any great war, in which

many a darkness into the light can leap,
And shine in the sudden making of splendid names.

But these "special names" can be, and are, made all the same. Scarcely a day passes in which some brave soul does not meet danger and death in the service of mankind; hardly a week goes by without showing abundantly that the spirit of self-sacrifice still exists, and that it only requires opportunity to turn the dull round of many an humble life into splendid heroism. At Haydock, the other day, it was found necessary to sink a furnace-pit, in connection with what is known as a Queen Pit. Only very few men can work in such a pit at the same time, and operations can only be carried on continuously by the employment of gangs. The work naturally entails a good deal of blasting, and, failing the electric battery, which ought always to be used in such cases, the fuse has to be lit by hand. It does not need a very vivid imagination to picture an occasion when, for some untoward reason or another, the men are unable to leave the pits, and have to calculate their remaining moments of existence by the rate at which the powder of the fuse burns away. It was an occasion such as this which drew forth the heroism of

Richard Gill. Three men went down into the furnace-pit at ten o'clock at night. One of them was Richard Gill, the hero of this narrative, a man 44 years of age, living at Stone-row, Haydock. They started work, and about an hour after midnight their charges were all laid, and nothing remained but to light the fuse and leave the pit. The workmen are raised by means of a hoppet, which a steam-engine lifts or lowers as required. Upon the rope of this hoppet hang, literally, the lives of the men engaged at work in the pit. If, when the fuse is lit, the rope should break, or anything go wrong with the apparatus, certain death must be the doom of those below. Hence great care is taken to prepare the engine man for the crucial moment. A bell is rung five times in order that he may get ready, and then, when the fuse which conveys fire to the deadly charge is lighted, one final ring informs the engine driver that the men must, without a moment's delay, be drawn up. On the occasion in question Gill rang the bell. The engine man having thus been ordered to get ready, there was a pause while the men stood ready to apply the match. Everything seemed all right and the fuses were lit. Hurriedly taking their places in the hoppet, they once more touched the bell and gave the signal to hoist. But the hoppet did not move. And then, all at once, it flashed across Gill's mind that he had only rung the bell four times. There was not a moment to be lost. Fearing that the engine-driver had not understood the signal, he rushed from the hoppet and frantically cut at the fuses. One of the four had yielded to the knife, when to the horror of the men who remained in the hoppet, the rope tightened and they began to move. Slowly, but surely, the hoppet rose, leaving poor Gill alone, face to face with death. There was but one chance. They might ring to have it lowered again; and all three might yet reach the top in safety. The brave man's brave companions saw this, and shouted to him to ring that it might be lowered. But, standing near the fuses as he did, Gill could see that the explosion would not much longer be delayed. It was a question whether he should die alone or whether he should force his companions to share his fate. He decided without hesitation. "Go on," he cried; "better one should die than all three. Good-bye!" The hoppet disappeared and Gill was left to meet death alone. Help on earth there was none. To whom could he turn? His two companions, according to the newspaper account, "Distinctly heard Gill praying." But "short time had he for shift or prayer;" for, ere the hoppet could reach the top, the explosion had taken place. The hero was afterwards found lying on the ground close to the place where he had cut off the fuse. "He was," says the newspaper account, "terribly injured, his skull being fearfully fractured." But he was not unconscious. He remembered what had taken place, and he could still speak. His words were few, but characteristic. He blamed no one, nor did he repine at his accident. "It was my own fault," was all he said. "The ambulance was got," concludes one reporter, simply, "and Gill conveyed to the Haydock Cottage Hospital, where he now lies in a very precarious condition. He is not expected to recover."

Unions and Strikes.

At a recent meeting of the Church Congress, held at Hull, England Mr. David Dale, of Darlington, in a paper, said that circumstances had forced upon him an intimate participation in the various modes by which, during the past twenty-five years, the terms and conditions of labor had been settled in the great industries of Durham and the North Riding of Yorkshire, and he confined himself to the results of actual experience. The first difficulty experienced in seeking to bring about a peaceful solution of the labor questions had arisen from the reluctance of employers and of influential public opinion to recognise the justification of a men's union. But, while regarding unions as useful in proportion to their numerical strength, he disapproved of the employer being made to compel men to join a union. To admit his right to do so was to admit the converse right to say, "You must not belong to a union." Where the existence or influence of a union was sustained by pressure of this sort, there was some inherent weakness in its constitution or management, for the individual worker was wonderfully ready to disregard his immediate personal interests when they seemed to be at variance with the permanent interests of his class. Much had been heard of the folly and wickedness of strikes, on account of the misery they entailed; but there was another aspect in the heroism which accepted suffering for future advantage, and renounced what was easiest for a common cause. With such feeling to work upon, it was unwise to apply compulsion to non-adherents. Then employers objected to negotiate with men who had not been, or who had ceased to be employed in the industry they represented. The scale of industrial enterprise rendered it necessary that the affairs of an important union should absorb the whole time of paid officers. The Durham Miners' Association utilised

properly the services of four capable and intelligent agents. The acceptance of the functions of umpire by men of distinction was amply justified by the vastness of the interest at stake. In many industries wages could be regulated by a sliding-scale; and this had much to recommend it where the wages had varied in some steady relation to the selling price of the commodity produced. The plan furnished to the workmen absolutely reliable information, usually extracted by public accountants from the books of the employers. Sliding-scales had worked well for many years in the pig iron trade and the manufactured iron trade of the north of England, in the coal industries of Durham and Northumberland, in the ironstone mines of Cleveland, in South Wales, and in many other important localities and trades. In some industries workmen had terminated them without assigning definite reason; but they well deserved consideration as a machinery tending to secure, promptly and automatically, an adaptation of wages to varying conditions of trade. Sometimes the road of peaceful arrangement was abandoned by a new generation of workmen who had not inherited their fathers' experience of how much more was to be gained by negotiation than by strife. This, may be, led to conflicts until the new generation gained its own experience, but their education would not take so long as did that of their fathers. The retrograde movement resembled the receding wave in an advancing tide. Till recently the Church had shared the feeling that organised labor movements represented unreasonable unrest and revolt against authority, and its precept was, "Servants, obey your masters in all things." But now it was recognised that there are reasonable claims below the surface exhibiting extravagant language, accompanied in some cases by unjustifiable action. Naturally, the clergy—having no special means to probe the depths of industrial questions—had been impressed chiefly by those incidents and views which the Press in earlier time gave prominence to. Now the attitude of the Church was one of broad general sympathy with the aspirations of labour to secure conditions which would admit of life being more than a struggle for existence. It regarded organisations for this object as justifiable and needful agencies. It would say that freedom of individual action should be inculcated, with a sympathetic recognition of the natural feeling on the part of those who joined a union that those who do not are going to take advantage of what is gained without contributing to the effort or sacrifice of seeking it. On the other hand, we should not pass from the former assumption that the employer must be right to the contrary assumption that the employer must be wrong. Let both parties be united in an honest desire to be candid and reasonable, but with a perfect knowledge or appreciation of each other's claims. The cases were rare in which it was expected for the representative of the Church to proffer mediation; his function was rather to cultivate those Christian virtues which tend to avert strife, but to do it with an intelligent knowledge of modern industrial conditions and of the special rights and obligations that attach to them.

Coal Mining in Natal

A Natal correspondent writing to the *Colliery Guardian* says:—"Having gone up the river beyond Ladysmith to see the Biggersberg extension, I thought it would be a good opportunity to visit the various coalfields in the colony, as all of them, with the exception of Ingagane and Newcastle, are situated on the line of railway extension recently completed, or within easy reach of it. Coal-mining in Natal on an important and systematic plan was commenced so recently that the history of the workings of any company is necessarily a brief one. Coal was known to be in existence on the ground now worked by the Elandslaagte Company for many years, and as a matter of fact coal was mined there by the military during the Zulu War. Then the Elandslaagte Company—a private concern by the way—was found to mine for coal there. They sunk a shaft just above the spot where the military mined, but the coal extracted was found to be of very inferior quality—in fact, it was taken from too near the shaft to be of much value—so the shaft was ultimately abandoned. Another shaft was then opened further west, and a considerable quantity of coal was taken from it. Up to the present time seven shafts have been sunk by the company altogether. When I visited the mines only two shafts were being worked out of the seven existing. The hands employed by the company are 110 natives, 35 Indians, 6 Europeans, 1 Creole. The company make their own cages, wagons for use underground, and other appliances on the spot, a smithy and carpenter's shop being in operation for the purpose. Sidings are run from the railway right up to the mouths of the shafts, and as the wagons full of coal are brought up from the mine on to the elevated platform, they are run along to a tipping apparatus at the other end, and their contents emptied at once into the railway trucks, passing over a screen in their descent. The coal is further picked over as it falls into the trucks, so that any shale

may be cast aside. The output of coal in the last week up to the time of writing from the two shafts being worked was 411 tons, and the output during the present month is expected to be about 2,000 tons. Coal of better quality than that present being mined has been taken from another shaft recently sunk on the company's ground. The property is shortly to be tested for deeper seams of coal by means of the second diamond drill, which arrived in the colony a short time ago, and is about to be erected 800 yards north-west of shaft B, under the superintendence of Mr. J. Thompson, who up to the present has had charge of the old drill. Most of the plant is already on the ground, but one or two parts have gone astray up the line, and difficulty is also being experienced in obtaining labor to transport the remainder of the plant from the station to the site. Still, it is hoped the drill will be in operation in the course of two or three weeks. The drill is exactly similar to the one that has been to work at some time on the coast. Mr. Thompson was good enough to explain its working to me. The drills, or crowns, used vary in diameter from 7 in. to 3 in., according to the depth at which they are worked. When near the surface the larger drill is used, and smaller ones are affixed to the rods as the depths increase. The drill is driven by steam power and revolves at the rate of 300 revolutions per minute. The cutting power lies in the diamonds which are affixed in the drill, there being from three to nine of them. As the drill revolves the core of stone, coal, or other formation cut round, rises up the center of the tube to which the drill is fixed. I saw specimens as hard as the solid rock. When the drill has penetrated 10 ft. it is drawn up, the core is extracted, and the drilling is then recommenced. The diamonds in a drill may be worth as much as £130. Whitestone is the most difficult stone found in Natal to work through, and Brazilian diamonds have to be used in cutting it, the Kimberley diamonds not being hard enough for the purpose. One of the most troublesome duties of Mr. Thompson is to fix the diamonds in the drill, the steel having to be cut away to fit the stones. The diamonds used are of a dark colour, and dull. The drill here is capable of penetrating to a depth of 2,000 ft., but not half that depth of drilling is likely to be required in Natal.

Annotated List of Canadian Minerals.*

G. C. Hoffman, F. Inst. Chem., etc.

1. ACADIALITE.—The flesh-red, brownish-red, purplish-red and yellowish-red varieties of chabazite (which have been named Acadialite) are found at Partridge Island, Swan Creek and Two Islands (Cumberland Co.), in the Province of Nova Scotia.
2. ACRITE.—Forms an important constituent of some of the nepheline-syenites of Montreal (Hochelaga Co.) and Belœil (Rouville Co.), in the Province of Quebec.—Anal., B. J. Harrington, Trans. Roy. Soc. Can., vol. i, sec. iii, p. 81, 1882 and 1883.
3. ACTINOLITE.—A bed of actinolite, mingled with an asbestiform serpentine and talc, occurs in the Township of Bolton (Brome Co.), and a finely fibrous variety, without admixture, constitutes a bed in St. Francis (Beauce Co.), Province of Quebec.
4. AGALMATOLITE.—Of a greenish-white to olive-green color occurs in layers in an indurated clay-slate at St. Nicholas (Levis Co.); of a honey-yellow color, forming a thin bed in clay-slate, in the Parish of St. Francis (Beauce Co.), and of an amber-yellow, with chloritic slates, on Lake Memphrémagog (Stanstead Co.), Province of Quebec.—Analyses, T. S. Hunt, Geol. Can., 1863, pp. 484, 485.
5. AGATE.—Many beautiful varieties are found in the trap regions of Nova Scotia; as on the shore extending from Sandy Cove to the head of St. Mary's Bay (Digby Co.); near Cape Blomidon in large blocks (King's Co.), and fine moss agates are met with at Cape Santé and at Scotch Bay (King's Co.), also at Two Islands (Cumberland Co.). Agates are found in abundance in the amygdaloids of Lake Superior, and sometimes of considerable size and beauty. They abound in rolled masses on the beaches of Michipicoten and St. Ignace Island, at Thunder Bay and elsewhere along the shore of this Lake,—Province of Ontario.
6. ALABASTER.—Considerable masses of a very beautiful snow-white gypsum or alabaster are met with in the gypsum quarries of Hillsborough (Albert Co.), in the Province of New Brunswick.
7. ALBERTITE.—This beautiful mineral has, so far, only been met with in King's, Albert and Westmoreland Counties, the most important locality being in the Parish of Hillsborough (Albert Co.), in the Province of New Brunswick. It is not found in beds, but in true cutting veins, which, although at times coincident with the bedding, are as often oblique or at right angles to it. The chief deposits, those of the Albert mines (in Hillsborough), occur in highly bituminous and oil-bearing shales situated near or at the base of the lower Carboniferous; but, at points not widely separated, veins of the mineral are found penetrating, for short distances, the

underlying metamorphic rocks—supposed to be of Huronian age—and the overlying and little disturbed beds of the millstone grit. The maximum thickness of the vein as first found near the surface was twenty-two feet, that of the smaller veins only a few inches, while the veinlets were often not thicker than a sheet of paper. It is estimated that since its first discovery (by John Duffy in 1849) some 200,000 tons of this material have been raised at the Albert mines. The deposit has, however, now become practically exhausted, and the mine in consequence abandoned.—(From information communicated by Prof. L. W. Bailey, of the University of New Brunswick.)

8. ALBITE.—Large cleavable masses of white albite, with quartz and mica, constitute a granite found at the Lake of Three Mountains, on the River Rouge, in the Township of Clyde (Ottawa Co.), and a faintly greyish-white, almost white, albite, exhibiting a fine bluish opalescence, occurs in large fragments in a coarse pegmatite vein—composed of quartz, muscovite, microcline, with occasionally black tourmaline, garnet, etc.—cutting a greyish garnetiferous gneiss, in the Township of Ville-neuve, also in Ottawa County, Province of Quebec. See also note to "Peristerite."

9. ALLANITE.—Small crystals of this mineral were found, by Dr. T. S. Hunt, in a felspathic rock near Bay St. Paul (Charlevoix Co.), and in a rock composed of labradorite and hypersthene from Lake St. John (Chicoutimi Co.), Province of Quebec. Also occurs (Prof. E. J. Chapman, Can. Jour., new series, vol. ix, p. 103, 1864) in the form of a narrow vein in granitoid strata at Hollow Lake, the head waters of the South Muskoka, in the Province of Ontario.

10. ALMANDINE.—The red garnet from the Stickeen and Skeena Rivers, as also many of the other red varieties alluded to under "Garnet," will, most probably, be found to be referable to this variety.

11. ALUNITE.—A massive, fine granular, light reddish-colored alunite, has been met with—associated with a greyish translucent quartz and specular iron—at New Ireland Road, Parish of Alma (Albert Co.) in the Province of New Brunswick.

12. ALUNOGEN.—Has been found, in the form of a crust of from 5 to 5½ cm. thick, on an old heap of shale at the Scotia mine, Springhill coal-field, Cumberland Co., Province of Nova Scotia.—Anal., F. D. Adams, Rep. Geol. Can., 1878-79, p. 8 H.

13. AMAZON-STONE.—Occurs abundantly, and of good color, in the Township of Sebastopol (Renfrew Co.), in the Province of Ontario. It has also been found in the pegmatite vein, referred to under "Albite," in the Township of Villeneuve, and is again met with in the Townships of Wakefield and Hull (Ottawa Co.), Province of Quebec.

14. AMETHYST.—Often of great beauty, is found at many places on the shores of Cumberland, King's, Annapolis and Digby Counties, Nova Scotia. The best localities are: Cape Sharp and Partridge Island (Cumberland Co.), Cape Blomidon (King's Co.), and Digby Neck (Digby Co.). Fine specimens occur in veins around Thnder Bay—more especially at Amethyst Harbor, and at the mouth of McKenzie's River—and at other points on the north shore of Lake Superior, Province of Ontario.

15. AMPHIBOLE.—See under "Actinolite," "Asbestos," "Hornblende," "Nephrite," "Pargasite," "Tremolite."

16. ANALCITE.—Fine specimens of this mineral are found at Cape d'Or, Swan Creek, and Two Islands (Cumberland Co.), also at Cape Blomidon (King's Co.), in the Province of Nova Scotia. It has been observed, in association with natrolite, in some of the dykes cutting the Trenton limestone at the reservoir extension, Montreal (Hochelaga Co.), in the Province of Quebec. Also occurs in the amygdaloidal traps of the north shore of Lake Superior, Province of Ontario.—Anal., B. J. Harrington, Rep. Geol. Can., 1877-78, p. 45 G.

17. ANDALUSITE.—Occurs in pale, flesh-red colored crystals in a fine grained micaceous schist at Moore's Mills (Charlotte Co.), Province of New Brunswick. Also found, in somewhat micaceous argillites, on Lake St. Francis (Beauce Co.), in the Province of Quebec. See also note to "Chiolite."

18. ANDISITE.—Occurs in large striated, cleavable masses of a reddish color, with hypersthene and ilmenite, constituting a rock at Château Richer (Montmorency Co.), Province of Quebec. Analyses, T. S. Hunt, Geo. Can., 1863, p. 478.

19. ANDRADITE.—Is found in pale, yellowish, honey-yellow and brownish-yellow colored crystals, imbedded in chalcopryite, and in yellowish-green colored masses, in association with white fibrous tremolite and dolomite, at the Malaspina copper mine, northeast side of Texada Island, Province of British Columbia.

20. ANHYDRITE.—Is met with in considerable quantities, constituting beds, in the gypsum deposits of Nova Scotia and New Brunswick.

21. ANIMIKITE — HUNTILITE — MACFARLANITE.—The minerals thus designated occur at the Silver Islet mine, Lake Superior, Province of Ontario. The two first named were described by Dr. H. Wurtz (Eng. Min.

Journ., xxvii, pp. 55 and 124, 1879), the last by T. Macfarlane (Can. Nat., 2 ser., vol. iv, p. 463, 1870), the results of whose investigations of the foregoing are given in the Trans. Amer. Inst. Min. Eng., viii, p. 236, 1880. [The true nature of the individual minerals present in the Silver Islet ores is still to be determined, but there is probably present a silver arsenide (Huntillite), and perhaps also a silver antimonide (animikite) allied to dyscrasite—(Dana, Min., App. iii, p. 71, 1882.)

22. ANKERITE.—This is one of the most plentiful and characteristic of the minerals filling the numerous fissure veins occurring at the base of the southern slope of the Cobequid Mountains, Londonderry (Colchester Co.), Nova Scotia.—Analyses, H. Louis, Trans. N. S. Inst., vol. v, p. 49, 1879-82.

23. ANORTHITE.—This felspar is one of the component minerals of the coarsely crystalline intrusive diorite of Yamaska Mountain (Yamaska Co.), in the Province of Quebec.—Analyses, T. S. Hunt, Geol. Can., 1863, p. 479.

24. ANTHRACITE.—Of the carboniferous system is not known to occur in Canada; there are, however, deposits of this mineral, of cretaceous age, on the Queen Charlotte Island—the best known locality being at Cowgitz, on Skidegate Channel, at the southern end of Graham Island—Province of British Columbia. For reference to analyses, see under "Mineral Coal."

25. ANTHRAXOLITE.—This name has been given, by Prof. E. J. Chapman, but simply as a convenient term for present use, to the black combustible coal-like matter which is not unfrequently met with in the Provinces of Quebec and Ontario. He describes it as follows: Black, lustrous, resembling anthracite in general characters, but very brittle. Hardness equals 2.25—2.50; specific gravity, 1.35—1.55. Generally decrepitates when heated. Before the blowpipe a small fragment loses its lustre, but exhibits no further change. Composition, essentially carbon, with from 3—25 per cent. of volatile matter, including a small amount of moisture, and ash varying from 0—11 per cent. Exhibits under the microscope no trace of organic structure. Dr. T. S. Hunt, in speaking of this material, says: "It can scarcely be doubted but that it has resulted from the slow alteration of liquid bitumen in the fissures of the strata." This would explain the great variability in the percentage of volatile matter (exclusive of moisture) which is observed in specimens from different localities, the amount of alteration having in some instances proceeded further than in others. It never occurs in true beds like coal, but is found either lining fissures or filling veins and fissures, sometimes several inches in diameter, in the limestones, shales and sandstones, and even in the trap rocks which traverse these. Sometimes it occurs in buttons or drops, forming botryoidal masses. It has been met with in many places in the Province of Quebec, viz., on the Island of Orleans, at Quebec and Sillery (Quebec Co.), Point Lévis, and St. Nicholas (Lévis Co.), Lotbinière (Lotbinière Co.), Drummondville (Drummond Co.), Acton (Bagot Co.), in the vicinity of Châte River in Gaspé, and elsewhere. In the Province of Ontario it has been observed filling fissures in the chert beds among the upper copper-bearing rocks of Lake Superior.—Analyses, T. S. Hunt, Geol. Can., 1863, pp. 524—526.

26. ANTIMONY, NATIVE.—In a lamellar, or, more rarely, finely granular form, occurs, in association with stibnite, valentinite, senarmonite and kermesite, accompanied by quartz and a little brown-spar, in veins in argillite in the Township of South Ham, Wolfe County, Province of Quebec.

27. APATITE.—The variety fluor-apatite is very common in the Laurentian rocks of Canada, where it occurs both in the form of veins and of large irregular shaped deposits or lenticular masses. The most important deposits are in the township of Buckingham, Templeton, Portland and Wakefield (Ottawa County), in the Province of Quebec, but extensive deposits also occur in the townships of North and South Burgess and North Elmsley, in the Province of Ontario. This mineral also occurs in connection with crystalline limestone—being found in the form of olive-green terminated crystals, with rounded angles, together with grains of purple fluorite, and crystals of black spinel, imbedded in a yellowish crystalline limestone, in the Township of Ross (Renfrew Co., Ont.); and crystals of blue apatite and quartz are imbedded in a coarsely cleavable, sky-blue calcite at the Calumet Falls (Pontiac Co., Que.). Small hexagonal prisms sometimes an inch in length and one or two lines in diameter, transparent, of a pink or purple color, with surfaces often dull, and angles rounded, occur, in association with crystals of augite, in an intrusive mass of fine grained, grey dolerite at St. Roch, on the Achigan River, L'Assomption County, Que.—Anal., T. S. Hunt, Rep. Geol. Can., 1863-66, pp. 203, on the composition of Canadian Apatites. G. C. Hoffmann, Geol., Can., 1877-78, p. 14H.

28. APHRIDITE.—Is found filling fissures in the massive pyrrholite of the Township of Grenville (Argenteuil Co.), in the Province of Quebec.—Anal., T. S. Hunt, Geol. Can., 1863, p. 473.

29. APOPHYLLITE.—Green and white crystals, aggregated in plates or in square prisms, occur at Two Islands

and Cape d'Or (Cumberland Co.), Blomidon (King's Co.), and Margareville (Annapolis Co.), in the Province of Nova Scotia. Also, in foliated masses or plates, often of a red color, in association with calcite, on Prince's Location, Spar Island, Lake Superior, Province of Ontario.

30. ARGENTITE.—Occurs, with native silver, chalcocite sphalerite, etc., in a vein of calcite at Prince's mine; with native silver, in a vein of barite, celestite and calcite, on Jarvis Island; with native silver, sphalerite, and a little galenite and pyrite, in a vein of barite and calcite on McKellar's Island; and with sphalerite, pyrite, nicolite, etc., in a veinstone consisting of calc-spar, bitter-spar and quartz, on Silver Islet, Lake Superior. With native silver, in a gangue of calcite, at the Duncan mine—also at the Rabbit Mountain, Porcupine, Beaver and other mines in the district of Thunder Bay (Lake Superior), Province of Ontario.

31. ARQUERITE.—Is found with alluvial gold upon Vital and Silver Creeks, Omenica District, Province of British Columbia.—Anal., H. G. Hanks, Dana, Min., App. iii, p. 4, 1882.

32. ARRAGONITE.—Is met, in the form of acicular crystals, varying in size from microscopic minuteness to an inch or more in length, lining fissures or cavities in the ankerite, or implanted upon barite or calcite, in the ankerite deposits of Londonderry (Colchester Co.), Province of Nova Scotia. Has been observed forming stalactites and delicate fibrous masses in a calcareous rock in the township of Tring (Beauce Co.), Province of Quebec, and sparingly amongst the Lake Superior traps, Province of Ontario.

33. ARSENIC NATIVE.—Is found, in veins, seven miles up Watson Creek, west side of Fraser River, twenty-five miles above Lytton, Province of British Columbia.—Ann. Rep. Geol., Can., vol. ii, p. 9T, 1886.

34. ARSENOPIRYTE.—Is of exceedingly common occurrence in the gold-bearing quartz bands of Nova Scotia. Is found, according to Dr. Hunt, well crystallized with galena in a quartz vein on the Chaudiere, in St. Francis (Beauce Co.); and still more abundantly in small crystals, in association with galena, in a large vein of quartz on Moulton Hill, near Lennoxville (Sherbrooke Co.), Province of Quebec. Occurs in large quantities in quartzose veins in the township of Marmora (Hastings Co.), and it is also met with in the township of Tudor, in the same county, Province of Ontario.

35. ASBESTUS.—A more or less delicately fibrous variety of hornblende has been met with in the townships of Templeton and Buckingham (Ottawa Co.), Province of Quebec. In the latter township, mountain cork was found in quantity and in masses of considerable size at the Emerald phosphate mine. Mountain leather has also been met with in this township as well as at the Beaver mine in the township of O'Connor, District of Thunder Bay, in the Province of Ontario. The fibrous variety of serpentine, which constitutes a large proportion of what is known in commerce as asbestos, occurs in quantity in the eastern townships of the Province of Quebec.—See under "Chrysotile."

36. ASPHALTUM.—Occurs in the vicinity of Oil Creek, in the southern part of the township of Enniskillen (Lambton Co.), Province of Ontario, where it forms two layers of a viscid consistency, known as gum-beds, occupying areas of about an acre each in extent, and having a thickness varying from a few inches to two feet. Another bed of bitumen, of from two to four inches in thickness, is met with at Petrolia, in the northern part of the same township. The material of this bed, which is more solid than that of those just referred to, and mixed with a good deal of earthy matter, is readily separable into thin layers, which are soft and flexible. Very extensive deposits of a bituminous sand-rock occur for great distances along the banks of the lower Athabasca River, North-West Territory; these are described in Rep. Geol., Can., 1882-84, part C.C., and the results of the examination of the material appear in Rep. Geol., Can., 1880-82, p. 3H.

37. AUGITE.—Well-defined crystals of black augite are found imbedded in the dolorites of Montreal (Hochelaga Co.), Rougemont (Rouville Co.), and Montarville (Chambly Co.) Mountains, in the Province of Quebec.—Anal., T. S. Hunt, Geol. Can., 1863, p. 468.

38. AXINITE.—Is said by Dr. Bigsby to have been found, in fine crystals lining a cavity in a boulder of primitive rock, at Hawkesbury (Prescott Co.), in the Province of Ontario. It has been found *in situ* by Dr. R. Bell, in small veins in trap, on the east coast of Hudson Bay, about one mile and a half south of the mouth of Little Whale River. Here it occurs, of a purplish-brown color, in association with epidote, imbedded in a matrix of calcite with a little quartz.

39. AZURITE.—Has, so far, not been met with in characteristic specimens, but merely as an incrustation on copper-ores, or in the form of stains and small earthy masses in copper-holding rock. Among the many localities where it has been observed may be mentioned: The Prince of Wales mine, Upton (Bagot Co.), and at the Black River mine—in a drusy calcite, with sulphurets of copper in the form of small crystals.—St. Flavien (Lot-

binière Co.), Province of Quebec. With green carbonate of copper at Batchewanung Bay and Prince's mine, Lake Superior, Province of Ontario.

40. BARITE.—Occurs, sometimes in very beautiful crystalline masses, in numerous irregular veins or pockets in the slates of the East River of the Five Islands (Colchester Co.), Nova Scotia; in a vein cutting Laurentian limestone, in the Township of Hull (Ottawa Co.), Province of Quebec; and the following localities in the Province of Ontario, viz., the Township of Bathurst and North Burgess (Lanark Co.) McNab (Renfrew Co.), Dummer and Galway (Peterborough Co.), and Summerville (Victoria Co.); also, constituting large veins, on Jarvis, McKellar's and Pie Islands, Lake Superior. Red crystals, associated with purple fluorite, are found on Iron Island, Lake Nipissing; and isolated pale reddish-yellow crystals have been found by Prof. Chapman (Can. Jour., Nov., 1885), in veins, in the Township of Neebing, near Fort William, Thunder Bay, Lake Superior, and subsequently in other mineral veins in that region.

41. BENTHIERITE.—Is mentioned (Dana, Minn., p. 68) as occurring near Fredericton, Province of New Brunswick. Prof. Bailey thinks the locality referred to would most probably be the autimony mine in the parish of Prince William, about twenty-five miles from Fredericton (York Co., N.B.).

42. BERYL.—Crystals of this mineral, having a diameter of three inches and more, and a length of from twelve to fifteen inches, have been met with, by Abbé J. C. K. Laflamme, in the township of Jonquière (Chicoutimi Co.), and it has also been found in the township of Brassard (Berthier Co.), Province of Quebec.

43. BIOTITE.—A dark bottle-green mica from Moore's slide (Roche-Fendue channel) on the Ottawa River, has been referred to this species.

44. BISMUTH NATIVE.—Was recognized by Prof. Chapman in some rolled pieces of quartz from near Echo Lake, on the north-west shore of Lake Huron, and agreeably with the observations of Dr. Hunt, it also occurs, in traces, in a veinstone in the township of Tudor (Hastings Co.), Province of Ontario.

45. BISMUTHINITE.—Has been met with, in small lamellar and sub-fibrous masses in a quartz vein at Hill's mine, in the rear of Tudor township, Hastings County, Province of Ontario.

46. BISMUTITE.—Has been recognized, by Dr. Hunt, as occurring in a quartz vein at Hill's mine, in the rear of the township of Tudor, Hastings County, Province of Ontario.

47. BITUMINOUS COAL.—Of the carboniferous formation occurs in the provinces of New Brunswick and Nova Scotia. In the former, though covering a large surface area, more than two-thirds of the entire extent of the province, the carboniferous or coal-bearing rocks have afforded as yet but little promise of large or valuable deposits, and with the exception of the beds at Grand Lake in Queen's County, which are about two feet in thickness, no stratum of bituminous coal, sufficiently large or pure to be profitably worked, has as yet been discovered. In the Province of Nova Scotia there are three important coal basins, viz., those of Cape Breton, Pictou and Cumberland counties—the first mentioned occupying an area of at least 190 square miles, with a thickness of not less than 7,000 feet of the carboniferous strata; the second occupies an area of only some 22 square miles, but several of the coal seams are of extraordinary thickness; the area of the Cumberland field is likewise small, but includes several good coal seams. Coal is not found in the Provinces of Quebec and Ontario; the black combustible coal-like matter referred to under "Anthracolite" is, however, met with in small quantity at various localities in both these provinces. In the North-West Territory, in the Rocky Mountains, and in the adjacent foot hills, there are extensive deposits of a bituminous coal which, although of Cretaceous age, is in all respects—physical character and chemical composition—undistinguishable from coal of the Carboniferous, and the same may be said of the coal of the extensive and important deposits, also of the Cretaceous age, which exist in various parts of British Columbia. For reference to analyses, see under "Mineral Coal."

48. BOG IRON ORE.—Occurs in great abundance at numerous localities in the Provinces of Quebec and Ontario. In the former, the most important sites are in the Three Rivers district, or between the rivers St. Maurice, Batiscan and St. Anne. Other deposits occur in the townships of Stanbridge, Farnham, Simpson, Ascot, Ireland, Eardley, Hull and Templeton—the seigniories of Vaudreuil, Lotbinière, Lauzon, St. Vallier and elsewhere. In Ontario it is met with, in greater or less quantity, in the townships of Charlotteville, Middleton, and Windham (Norfolk Co.), Camden (Kent Co.), Bastard (Leeds Co.), etc.—Analyses, T. S. Hunt, Geol. Can., 1863, p. 510.

49. BORNITE.—Occurs, most commonly associated with chalcocite and chalcocite, in the townships of Cleveland and Melbourne (Richmond Co.), Acton (Bagot Co.), Leeds and Halifax (Megantic Co.), Sutton (Brome Co.), and elsewhere in this section of the Province of Quebec. It has been found at the West Canada Mines

on Lake Huron, also at some points on Lake Superior, in the Province of Ontario—and near the head of Salmon Arm of Jarvis inlet, and between that inlet and Howe Sound, Province of British Columbia.

50. BYTOWNITE.—The name given by Dr. Thompson to a greenish-white feldspathic mineral found in a boulder, near By-Town (now the City of Ottawa), in the Province of Ontario,—and which has since been shown by Zirkel (Tsch. Min. Mitth., 1871, 61,) to be a mixture. An analysis of a portion of the specimen upon which Dr. Thompson founded the species is given by Dr. T. S. Hunt in the Geol. Can., 1863, p. 479.

51. CACHOLONG.—Beautiful specimens of this mineral are obtainable on the coast between Capes Split and Blomidon (King's Co.), in the Province of Nova Scotia.

52. CACOCALASITE.—The cacocalsite of Prof. H. C. Lewis (The Naturalist's Leisure Hour and Monthly Bulletin, A. E. Foote, No. 87, Exposition Extra, 1885), has quite recently been submitted to a careful re-examination by Dr. F. A. Genth, and shown not to be a good species.—Am. Journ. Sci., 3 ser., vol. xxxviii., p. 200, 1889.

53. CACOXENITE.—Has been observed by Dr. Harrington as occurring in the form of beautiful little yellow tufts on the walls of cavities in calcite at the pyrite deposit near Brockville, in Elizabethtown, Province of Ontario.

54. CALCAREOUS TUFF.—See note to "Travertine."

55. CALCITE.—Is found in large rhombohedral, also modified crystals, at Partridge Island (Cumberland Co.), and on the coast between Capes Split and Blomidon (King's Co.), and a very fine apple-green calcite is found at McKenzie's River (Inverness Co.), Province of Nova Scotia. A coarsely cleavable sky-blue calcite occurs at the Calumet Falls in Lichfield (Pontiac Co.), also in the township of Wakefield (Ottawa Co.), and a yellow, cleavable calcite, also a fibrous variety, in the township of Templeton (Ottawa Co.), Province of Quebec. A salmon-red, cleavable calcite in the township of Sebastopol, Renfrew County, in the Province of Ontario. Crystalline limestone, suitable for employment as marble, for architectural purposes, occurs in most, and is very abundant in some of the provinces of the Dominion. White, red, grey, brown and black (and various shades of these colors) varieties are met with respectively at:—St. Armand (Missisquoi Co.), Caughnawaga (Laprairie Co.), Duds-well (Wolfe Co.), Point Claire (Jacques Cartier Co.), St. Dominique (Bagot Co.), St. Joseph (Beauce Co.), etc., in the Province of Quebec—and Annprior (Renfrew Co.), Cornwall (Stormont Co.), L'Original (Prescott Co.), Pakenham (Lanark Co.), and elsewhere in the Province of Ontario. See notes to "Dog-tooth-spar," "Foetid calcite," "Iceland-spar," "Nail-head-spar," "Travertine." For a list of minerals of the Laurentian limestones, see report "On the Laurentian limestones of North America," by Dr. T. S. Hunt, Rep. Geol. Can., 1863-66, p. 181, *et seq.*

56. FOETID CALCITE.—A milk-white, cleavable, foetid calcite, forms a large bed in the township of Grenville, and is also met with in the adjoining township of Chatham (Argenteuil Co.), Province of Quebec.

57. CANCRINITE.—Occurs in the nepheline-syenites of Montreal (Hochelaga Co.), and Beloeil (Rouville Co.), Province of Quebec.—Anal., B. J. Harrington, Trans. Roy. Soc. Can., vol. i, sec. iii, p. 81, 1882 and 1883.

58. CANNEL COAL.—Occurs at Little Glace Bay, Cape Breton, Province of Nova Scotia.—Anal., H. How, Phil. Mag., 4 ser., vol. xxxvii, p. 268, 1869.

59. CARNELIAN.—Is found at Blomidon (King's Co.), at Trout Cove (Digby Co.), and the north shore of Granville (Annapolis Co.), Province of Nova Scotia.

60. CASSITERITE.—Small quantities of this mineral, in the form of minute grains, were found to be associated with the Sperryite obtained at the Vermilion Mine, in the township of Denison, District of Algoma, Province of Ontario.—(H. L. Wells, Am. Journ. Sci., 3 ser., vol. xxxvii, p. 68, 1889). Very small quantities of this mineral, in the form of minute crystals, have also been found by Dr. Genth (prov. com.) in some tailings from the Battery lead, Malaga gold mining district, Queen's County, Province of Nova Scotia.

61. CELESTITE.—Occurs in white translucent crystalline foliated masses, which are sometimes radiated, and often several inches in diameter, in the Black River or Trenton limestone of Kingston (Frontenac Co.), in large crystallized masses, semi-transparent and of a bluish or occasionally, in parts, pale reddish color, in a vein cutting Laurentian limestone in the township of Lansdown (Leeds Co.), in radiating fibrous masses, constituting a vein in the Laurentian strata of Bagot (Renfrew Co.); a red variety, in cavities in dolomite, at the forks of the Credit, township of Caledon (Peel Co.) Other localities in this Province (Ontario) are:—Owen Sound, Drummond and Grand Manitoulin Island (Lake Huron), etc.

62. CENTRALLASSITE.—Is found in trap of Triassic age near Black Rock (King's Co.), in the Province of Nova Scotia.—Anal., H. How, Ed. N. Phil. Jour., new series, vol. x, p. 84, 1859; Phil. Mag., 5 ser., vol. i, p. 128, 1876.

(To be Continued.)

Some Ontario Magnetites.

By T. D. Ledyard, Toronto, Canada.

Sir William Logan, our great geologist, predicted that Canada would become eventually one of the greatest iron-producing countries of the world. Although possessed of numberless deposits of iron-ore, we have not yet done much to verify this prediction. Causes can be found for our backwardness, the principal one being the want of a market. A glance at the map shows that the small population of Canada is too scattered to support extensive iron manufactures. Six good-sized iron-mines would supply the ore necessary to make all the iron and steel used in Canada, even if we used nothing but our own make instead of importing the greater portion, as we do at present. And distances in Canada are too great in proportion to the small consumption to encourage home manufactures on a large scale.

But while Canada is suffering for want of a market, many parts of the United States would be benefited by the free admission of Canadian ores. The Eastern States could get cheap ores from Quebec and Nova Scotia, and many Pennsylvania furnaces could obtain Bessemer ores from Ontario at much lower rates than they are now paying for imported foreign ores.

GEOLOGY OF THE ONTARIO IRON-DISTRICTS.

Dr. Robert Bell, Assistant Director of the Geological Survey of Canada, in his "Geology of Ontario,"† says: "The name Huronian (derived from Lake Huron) was first given by the Geological Survey of Canada more than forty years ago, and has been adopted by geologists in other countries as universally as the term Laurentian, and is made to include all the rocks lying between the Laurentian below it and the Cambrian or earliest fossiliferous rocks above. Some of the rocks of the district stretching between the Counties of Lanark and Hastings in eastern Ontario, which were formerly included in the Laurentian series, are now believed by some to belong rather to the Huronian. An attempt has been made quite lately, among some American geologists, to restrict the name Huronian to rocks like some of those north of Lake Huron, although Sir William Logan and his colleagues, in introducing the term originally, described it as applying equally to the dark grayish and greenish schists, conglomerates, diorites, etc. The more extended investigations which have since been made in Canada and other parts of the world have confirmed the propriety and convenience of including under this name all the rocks which had been originally described as Huronian.

"The Huronian, as above defined, is the great metalliferous system of Ontario, as well as of northern Michigan and Minnesota, and hence its great importance in the economic geology of the country. The whole series is more or less metalliferous, but the various ores are not uniformly distributed, some occurring in one region or in some special stratum, while others may prevail in another section of country or in a different horizon in the series. Iron appears to occur most frequently in the lower or schistose portions of the Huronian system."

SOME MAGNETITE-DEPOSITS.

This paper will be confined to a short description of certain ores found in the Counties of Peterboro and Haliburton, and in the more easterly portions of the Province of Ontario. Those which will be mentioned are probably among the most important, yet comprise only a few of the ores which have come under the writer's notice. Magnetites only will be here taken into account, although hematites are found in these districts in deposits of considerable importance and sometimes of great purity.

Prof. E. J. Chapman, Ph.D., of the School of Science and University College, Toronto, says:

"This area of Ontario is traversed in a general north-east and southwest direction by belts of elevated rocky land, consisting of unstratified, probably eruptive, syenites or syenitic granites of a prevailing red colour. Between these belts lie rugged tracts of essentially synclinal structure, occupied in ascending order by strata of red and gray gneiss and by some crystalline graphitic limestones, succeeded more or less irregularly by dark green amphibolic and pyroxenic rocks, with which the iron-ores are chiefly associated."

The Belmont Iron-Mine.

About 110 miles east of Toronto, 6 miles north of the branch of the Canadian Pacific Railway, between Toronto and Montreal, on Lot 19 in 1st Concession of the Township of Belmont, County of Peterboro, is found a large deposit of rich magnetic ore, closely resembling in mode of occurrence some of the Lake Superior mines. Experts estimate that this ore-bed contains at least 1,000,000 tons of ore within 100 feet of the surface, from which there should be no difficulty in producing 400 or 500 tons a day.† The ore is very high in metallic iron, and by no means refractory in the blast-furnace. Samples taken from the pits possess a fine texture, and show but small traces of phosphorus and sulphur, with a high percentage of iron, constituting an almost ideal Bessemer ore.

The stripping is so light that the ore should be mined, by the use of compressed-air drills, at a cost of 50 cents

per ton, being so free from rock-matter that little culling will be required.* No trouble with water is to be anticipated, the ground possessing a natural drainage to the west, which can be improved and utilized at slight expense.

A special feature of this deposit is its proximity to the surface, necessitating but little expense for stripping, as mining can be done in pay rock almost from the commencement.† Some hematite is found on the east side in conjunction with soapstone.

Prof. Chapman says: "This is an exceedingly good ore, not too dense in texture, rich in metal, quite free from titanium and practically free from phosphorous and sulphur, and is well adapted for the Bessemer process."

The following analyses have been made, the first being from surface samples.

No.	Metallic Iron.	Phosphorous.	Sulphur.	Silica.	Manganese.
1	64.26	Faint trace.	0.04	.....	.....
2	65.36	0.002	Trace.	4.5	.. ..
3	66.29	0.024	Trace.	3.19	0.42
4	68.88	0.006	Trace.	3.18	.....
5	68.85	0.008	Trace.	1.96	.....
6	69.99	0.012	Trace.	3.10	.....

No. 1 was made May, 1884, by Prof. E. J. Chapman; No. 2, July, 1886, by W. F. Brugman, chemist of the Scranton Steel Co.; No. 3, November, 1887, by the chemist of the Joliet Steel Co.; No. 4, same date, by Prof. Davenport Fisher, Milwaukee; Nos. 5 and 6, August, 1888, by the chemist of the Cambria Iron Co.

Much of the rock-matter surrounding this ore-deposit is composed of epidotic diorite.

The Blairton Iron-Mines.

Four miles south of the Belmont mine are the Blairton iron-mines, at the village of that name, on Lot 8, in 1st Concession of Belmont, about 2 miles from the Canadian Pacific Railway.

At this place originally known as "the big ore-bred," there are large deposits of magnetic iron-ore, averaging probably 50 to 55 per cent. metallic iron, and low in phosphorous, with no titanium. Analyses have shown 0.035 phosphorus.

A considerable amount of ore has been taken out of these mines, as much as 300 or 400 tons daily having been produced here at one time. A large and deep excavation has been made, 150 feet wide by 250 feet long, and a second opening 160 feet deep lies south of the first.*

On the east side of the deposit is capped with Silurian limestone, while the west wall is a jaspery quartzite. The strike is west of north. In the wall, quartz and serpentine predominate. This ore is much mixed with rock, necessitating a good deal of culling, which renders mining expensive; and there has been sulphur in some parts of the deposit from the beginning.

This is one of the many iron-mines in Canada which cannot be worked at a profit for export under the United States duty of 75 cents per ton. If there were no duty this mine would doubtless be worked; it is capable of producing largely. At present the only use that can be made of such ore is to smelt it in a local charcoal furnace, there being plenty of hard-wood in the neighbourhood from which charcoal can be cheaply made, and limestone for flux not being far distant.

Central Ontario Railway Mines.

There are several large deposits of magnetic ore on or close by the Central Ontario Railway in the north part of the County of Hastings. Some of these ores are of Bessemer quality (after roasting out the sulphur), but unfortunately the mines are now lying idle, owing to serious dissensions among the owners. The statement has been made that these ores are worthless, and that the mines are not worked on account of the sulphur in the ore; but this is surely not the true reason. Nearly 800,000 tons of magnetic iron-ore are annually taken out of the Cornwall hills in Pennsylvania and used as Bessemer ore, although containing an average of 2 per cent. sulphur and only about 48 per cent. metallic iron; and nearly 700,000 tons of other sulphurous ores, some of them being hard magnetites from the States of New York and New Jersey very similar to Central Ontario ores, are annually used in the United States. The sulphur entails an additional cost in roasting; but where other injurious elements are absent, a sulphurous ore, after being properly roasted, often can be used in the manufacture of Bessemer iron.

The roasting should be carefully done in Davis-Colby or other suitable roasters, where plenty of oxygen is sup-

plied during the process. The ore should be broken up fine enough and plenty of time given to make the roasting effectual.* This should be done where fuel is cheap, at a cost not exceeding 25 cents per ton. The cheapness of mining and freight would much more than counter-balance this expense on some Ontario ores.

Many of the Central Ontario ores could be conveniently shipped to furnaces in Pennsylvania by returning American coal-cars, which bring coal into Canada, but now usually return empty.

SNOWDEN IRON DISTRICT.

The townships of Snowden, Galway and Glamorgan in the County of Haliburton, about 40 miles northeast of Lindsay, contain several valuable deposits of iron-ore.

Lots 25, 26 and 27, in the 4th Concession, Snowden, on the south side of Burnt river, contain several outcrops of magnetite extending about three-quarters of a mile. This ore is on high ground overlooking the river and railway-track, and most conveniently situated for mining by drifts or tunnels run into the hillside, the mine-cars running by gravity to the shipping platforms or pockets at the railroad.

The following analyses show these ores to be very low in phosphorus:

No.	Metallic Iron.	Phosphorus.	Sulphur.	Silica.	Titanium
1	61.48	0.01	0.16	.....	None.
2	62.	Trace.	0.025	1.7	"
3	62.57	0.025	Trace.	.....	"
4	63.	Trace.	0.025	3.1	"

No. 1 was made by Prof. E. J. Chapman; Nos. 2, 3 and 4 by chemists of different iron-works in Pittsburgh, whose names are not in my possession.

Concerning analysis No. 1, Dr. Chapman says: "A fine-grained, magnetic ore from the Howland mine, Lot 26 in 4th Concession, Snowden. The ore near the surface is very pyritous, but becomes almost free from pyrites in descending. The sample was taken from a depth of 81 feet from the surface. A second shaft has been sunk on another part of the deposit to a depth of about 30 feet. The deposit is apparently an elongated stock-formed mass of large extent. It has been opened over a length of about 80 feet."

The railway passes through Lot 20 in 1st Concession, Snowden, on which are several outcrops of magnetite, one of them cross-cutting the Monck road, where it was first discovered. Prof. Chapman has analyzed a surface-sample and found it to contain metallic iron, 60.18; phosphorus, 0.08; sulphur, 0.04; titanate acid, 0.73. He describes it as a black magnetic, fine grained ore, somewhat porous in texture. The deposit is apparently a stock-formed mass of large size, as shown by recent borings and excavations. Another analysis is given, showing metallic iron, 61.02; phosphorus, 0.052; and still others have shown metallic iron as high as 65%.

This district is about 200 miles from Buffalo, N.Y., to which point the ores could be delivered very cheaply in returning coal-cars. Moreover, these deposits are not much more than 100 miles from Midland, Ontario, whence ore could be shipped by boat to Chicago in returning grain-vessels. Limestone suitable for flux is found in close proximity to the ores, and there is abundance of hard-wood suitable for charcoal. There is also brown hematite in the neighborhood, yielding 45 to 48 per cent. metallic iron which would mix well with the magnetic ores in a charcoal-furnace.

The Paxton mine, in the adjoining township of Lutterworth, has produced several hundred tons of ore yielding 55 to 60 per cent. iron with no titanium and traces only of sulphur and phosphorus.

Ores from different parts of Galway Township, south of Snowden, have given the following analyses:

No.	Metallic Iron.	Mang. oxide.	Phosphorus.	Sulphur.	Titanium
1	62.37	Trace.	0.012	Slight trace.	None.
2	62.60	1.27	0.008	Slight trace.	"
3	65.	.....	0.04	0.02	"
4	70.40	.....	Trace.	Trace.	"

Nos. 1 and 2 were made by Prof. Chapman; Nos. 3 and 4 by Prof. Thos. Heys, formerly lecturer on chemistry in the Toronto School of Medicine.

VARIOUS ORE-DEPOSITS.

Professor Chapman has also made the following analyses of magnetites from this district which are free from titanium, viz.: Nos. 1,* from the Township of Glamorgan. A black crystalline, highly cleavable ore, carrying 70.38 metallic iron, with merely traces of phosphorus and sulphur. There are a few ore-exposures and needle-attractions showing a strong body of ore extending over a length of about 400 feet by 40 feet in width. No. 2 is an ore corresponding almost exactly in its cleavable structure and composition with No. 1, although it comes from another place several inches. Samples taken from a small trial-pit show 70.5 per cent. metallic iron with rock-matter under 3 per cent., but the ground is practically undeveloped.

No. 3. A black, fine granular ore from the vicinity of Apsley village, in the northern part of the township of Burleigh. Metallic iron, 63.68 per cent.; phosphorus, a trace only; and sulphur, 0.03. The intermixed rock-matter is essentially pyroxenic. Ground undeveloped.

No. 4. A very rich magnetic ore from the township of Madoc, the dried ore yielding 69.16 metallic iron; phosphorus, 0.04; and sulphur 0.03, with siliceous rock-matter, 3.32.

No. 5. A magnetic ore mixed with specks of actinolite from Madoc township. The sample contained nearly one per cent. pyrites and yielded iron, 60.32; phosphorus a trace; and sulphur, 0.52. Another sample from the same property gave iron, 62.54; phosphorus, 0.03. and sulphur, 0.38.

KINGSTON AND PEMBROKE DISTRICT.

The following analyses have been made of magnetic ores from the country tributary to the Kingston and Pembroke railway.

No	Metallic Iron.	Phosphorous	Sulphur.	Silica.	Titanium
1	65.33	0.017	.....	.....	None.
2	66.	Trace.	Trace.	2.14	"
3	62.	0.006	Trace.	4.12	"
4	60.	0.009	.....	6.31	"
5	52.	0.055	0.10	6.53	"
6	65.07	0.07	0.05	6.66	"
7	66.34	0.14	Trace.	1.04	Trace.

No. 1 was made June, 1883, by Ledoux and Ricketts; Nos. 2, 3, 4 and 5 by a chemist employed by the Kingston and Pembroke Iron and Mining Co.; No. 6, November, 1871, by J. Blodgett Britton; No. 7 by a chemist unknown to me. This analysis, with Nos. 2, 3, 4 and 5, was published by the Minister of Agriculture in connection with the mineral exhibit of Ontario at the Cincinnati Exhibition of 1888.

TITANIFEROUS ORES.

In Minden, the township lying north of Snowden, there are large quantities of magnetic ores containing a considerable amount of titanium. A black, granular, strongly magnetic ore from near Lake Kushog showed by Dr. Chapman's analysis the following results: Metallic iron, 51.56; Titanium, 15.64; Sulphur, 0.17; Phosphoric acid, trace; Siliceous rock-matter, 4.08.

Similar ore is found on several adjoining lots, and there appears to be a good deal of titaniferous ore in this and neighboring townships.

There is an enormous deposit of black, strongly magnetic ore in the township of Glamorgan, about half a mile south of Burnt River. The deposit rises abruptly in the form of a succession of ledges to a height of from 80 to 100 feet above the general level of the ground, and is exposed in an easterly and westerly direction for at least 1,800 feet, with an average width of 140 feet. The analyzed sample contained 52.04 metallic iron; 8.11 titanium; 0.005 phosphorus; and 0.005 phosphorus; and 0.06 sulphur.

Another deposit of similar ore has been found some distance from the one just described. This ore carries from 8 to 10 per cent. titanic acid, which appears to be persistent throughout the whole ore-bed, the yielding of metallic ore being nearly 60 per cent.; phosphorus 0.007; and sulphur 0.08.

It may be remarked that titaniferous ores in these districts are generally very low in phosphorus, and if some treatment could be found whereby the injurious effects of the titanium could be got rid of they might be used in making steel.

Dr. Chapman remarks that "the presence of these titaniferous ores in close proximity to deposits in which no trace of titanium can be detected, is a fact of much interest hitherto apparently unrecognized in the iron-districts of Europe."

The writer feels warranted in protesting against the habit, which has prevailed in some quarters, of characterizing all Canadian ores as titaniferous. Nothing could be more unfair. Canada is a country of great extent, and it is just as absurd to class all Canadian ores as titaniferous because those objectionable ores are found in some places, as it would be to condemn Lake Superior ores because titanium is found in some parts of northern Minnesota.

Ontario contains, as I have shown, many ores perfectly free from titanium, although there are certain ranges or belts of territory in which titanium prevails to a considerable degree.

Many of the magnetite deposits in eastern Ontario are rich in iron, and carry, too, very low percentages of phosphorus and sulphur with no titanium at all. Others are high in sulphur but still free from other impurities, so that they require roasting only, in order to make them available as exceedingly pure 60 per cent. ores. Finally, the rates of wages in these districts generally range from \$1 per day for laborers to \$1.25 for miners; and, as has been observed, the commercial conditions of transportation are exceedingly favorable. Nothing seems to be lacking but access to the market of the United States.

* Paper read before the American Institute of Mining Engineers.

† Mineral Resources of Ontario, pages 17 to 22.

‡ Prof. Heys, Report, 1885, and Prof. C. Gordon Richardson, Report, 1890.

* Report of F. D. Taylor, M.E., 1886.

† Prof. C. Gordon Richardson, Report, 1890.

* Report of the Royal Commission on the "Mineral Resources of Ontario," 1890, p. 127.

* See Dr. Valentine's paper of October, 1889, *Trans.*, xviii.

* These five analyses are numbered in Professor Chapman's list 9 to 13 inclusive.

† All the analyses of titaniferous ores here given were made by Prof. Chapman.

Phosphate Shipments.

The following have been the shipments of phosphate from the Port of Montreal, as per Custom House manifests, since our last advice, to date:—

Date.	Name of Ship.	Destination.	Shippers.	Quantity.
Sept. 27	SS Kehrweider	H'mburg	Wilson & Green...	150
" 27	do	do	Lomer, Rohr & Co.	85
" 20	Gerona.....	London .	do ..	152
" 30	Barque Medbor....	Q'ntown	do ..	84
Oct. 3	SS Erl King	London .	do ..	220
" 6	Borghesa.....	Glasgow.	do ..	185
" 8	Dominion.....	Liverpool	do ..	330
" 9	Cremon	H'mburg	do	200
" 13	Barque Skudensnaes.	Grimsby.	Wilson & Green...	75
" 13	SS Ripon City	Hull.....	Millar & Co.....	200
" 13	do	do	Lomer, Rohr & Co.	120
" 20	Oxenholme	Liverpool	Wilson & Green...	570
To Europe.....				2371 tons

SHIPPER'S RECAPITULATION.

	Tons.	Bags.
Lomer, Rohr & Co., (to 19th June) ..	2,715	100
do (to 23rd July) ..	1,830	100
do (to 23rd Aug.) ..	1,845	..
do (to 20th Sept.) ..	1,350	20
do (to 13th Oct.) ..	1,376	..
Millar & Co. (to 18th June) ..	1,475	..
do (to 15th July) ..	1,540	..
do (to 23rd Aug.) ..	300	..
do (to 6th Sept.) ..	1,140	..
do (to 13th Oct.) ..	200	..
Wilson & Green, (to 16th June) ..	823	..
do (to 22nd July) ..	2,132	..
do (to 23rd Aug.) ..	559	..
do (to 20th Sept.) ..	725	..
do (to 10th Oct.) ..	795	..
		5,934
		18,805 220

RECAPITULATION OF EXPORTS.

	Tons.	Bags.
Liverpool—Previously reported	8,720	100
do Reported to 25th Sept.	900	..
Reported to date.....	..	..
London—Previously reported	3,540	..
do Reported to 20th Sept.	372	..
Reported to date.....	..	..
Hamburg—Previously reported	1,914	..
do Reported to 20th Sept.	435	..
Reported to date.....	..	..
Glasgow—Previously reported	1,355	120
do Reported to 20th Sept.	185	..
Reported to date.....	..	..
Swansea—Reported to date.....	..	..
Hull—Previously reported	500	..
do Reported to 20th Sept.	320	..
Reported to date.....	..	..
Newcastle—Reported to date.....	200	820
Grimsby, reported to date.....	75	200
Queenstown, " ..	84	75
U. K. Ports, " ..	75	48
		75

Total exports to Europe since opening of navigation to 20th Oct., 1890 18,805 220

MINING NOTES.

Nova Scotia.

(From Our Own Correspondent.)

Pictou County.

Mr. T. Turnbull, manager, and Mr. W. B. Moore, of the Vale Colliery, have resigned.

The engine-house at the East River mine, operated by Messrs. John Muir & Sons of New Glasgow, was destroyed by fire last month. The loss is estimated at between \$600 and \$700, not covered by insurance. The building has been rebuilt and equipped with a new boiler.

A party of 27 miners left Stellarton this month for work at the mines of the Alberta Railway and Coal Company at Lethbridge, Alta, N.W.T. Another party will leave shortly.

The Steel Company of Canada declared a dividend of ten per cent. at its last annual general meeting.

Cumberland County.

The Londonderry Iron Company is getting ready to put its second furnace in blast.

The English syndicate which recently acquired the Joggins mine in Cumberland County is reported to be in treaty for the railway connecting the mine with the Intercolonial Railway at Macan. The line, which is about eight miles long, runs parallel with the outcrops of the seams of the north edge of the basin, and will prove of value, as it connects with shipping facilities at the Joggins and River Hebert. The figure named is said to be \$180,000.

Mr. James Baird, formerly manager of the Chignecto colliery, is now in charge of the Joggins colliery, and is introducing the system of working from bond and pillar to long-wall. The miners are favorably disposed to the change, which they think will better their condition. Quite a number of men from the other mines are seeking employment under Mr. Baird's popular management.

The airways at the Springfield colliery have been enlarged, greatly improving ventilation. The shipments for September were fully 40,000 tons, and an increase in the returns for October is anticipated.

Cape Breton.

At the Caledonia mines there are ninety-five pairs of cutters employed, a larger force, probably, than ever before were employed. The output from the mine is close upon 600 tons per day.

In consideration of the early starts made by the miners, in order to give quick despatch to steamers, Mr. David McKeen, M.P., the popular managing director, has granted a bonus of one hundred dollars to Equity Lodge. This affords sufficient proof, says the *Stellarton Journal*, that our manager recognizes the Lodge as the proper party with which to do business. And Mr. McKeen is right; better to do business with a responsible committee than with a lot of irresponsible bodies.

At the Bridgeport collieries work continues steady, and is expected to continue so for some time yet.

At Sydney mines the output is estimated to be quite 700 tons per day. 118 pairs of cutters are employed.

Gold Mining Supplies.

The principal depot in Nova Scotia, carrying the most complete assortment of first class goods, is

H. H. FULLER & CO'S
41 to 45 Upper Water St., Halifax, N.S.

Our line comprises Explosives, Fuse, American and English Mill and Hammer Steel, Bar and Bolt Iron, Steel Wire Hoisting Rope, Hemp and Manilla Rope, Rubber and Leather Belting, Miners' Candles, Oils and Lamps, Miners' Tools, Machinists' Tools, Blacksmiths' Tools, and every requisite for the gold miner.

H. H. FULLER & CO.,
Halifax, N.S.

COXHEATH COPPER MINES.—Developments continue to be satisfactory to the management. The 260-foot cross-cut north from No. 2 shaft has cut vein "B" at 87 to 103 feet from the shaft, showing the width of the vein at this level to be 16 feet; it contains eight feet of good ore next to the hanging wall, the remainder being partly of lower grade, with streaks of rich ore. One of these streaks lying on the foot wall is 15 inches wide. The average of the vein is fully as high as at the 184-foot foot level, where it was estimated to be 10 per cent. copper. The hanging wall is dipping to the north and the foot wall to the south, indicating a further increase in width with depth. Shaft No. 1 is unwatered down to the 60-foot level. From this depth the old cross-cut south into the mountain is already in 70 feet, and will be at once continued to intercept known veins discovered since work at this shaft was suspended. At the new vein on the mountain the shaft is down 25 feet, the bottom being all in ore; this shaft will hereafter be known as No. 3 shaft. Tunnel between No. 1 and No. 2 shafts is in 130 feet. An additional force of 15 workmen are now cross-cutting the surface opposite the lake, 2,000 feet west of No. 2 shaft. Eight Rand power drills are now constantly at work on the property, and the other two will be started at an early day. Since the reports on the mine, rendered last July, over 6,000 tons of additional ore have been put in sight on vein "B" alone.

Caribou District.

The Halifax Mining and Prospecting Company have acquired the property adjoining the colliery to the Westward, formerly worked by Daniel Tonquoy, and are erecting light pumping and hoisting gear upon the same. The property is a wet one, and considerable water will have to be handled. Mr. Edward Whidden will have charge of the work.

Central Rawdon.

Work in the mines of the Northup Mining Company, Ltd., was suspended about the middle of September, but about the 10th of this month was partially resumed. The company are sinking two shafts by contract, and it is understood that other work will be suspended pending developments made by these shafts.

The yield of the Central Rawdon Company has also largely fallen off, and no large returns have been made for some time.

Whiteburn District.

The mills of the Rossignol and Queen's companies are rapidly approaching completion, and will probably be stamping quartz ere this is in print. Both are under the management of Mr. Julius Puttner, late of Malaga District.

Malaga District.

Matters seem to be very quiet here at present. The Parker-Douglas Company are working steadily, and report most excellent results from the Golden Gate concentrator which has been lately added to their mill.

From the Malaga Mining Company there is no news. Since Mr. McGuire resigned the superintendency Mr. Alfred Wade has been acting in that capacity. It is understood that the working force has been confined to the Rabbit Lodes.

Waverley District.

The Nova Scotia Syndicate, at the Windsor Junction mine, has ceased all work except that of widening and straightening the pump-shaft at the eastern end of the Union lode. It is proposed to make this the permanent hoisting-shaft for the present, and a skip-track will be put in as rapidly as possible. Manager MacDuff is putting in a new hoisting engine at this shaft, manufactured by W. W. Howell & Co., of Halifax.

The mill of the Lake View Company started up the last week of September, and has been running, with occasional stops for adjustments, ever since. The mill contains twenty stamps and eight fine vanners, and the manager, Mr. A. A. Hayward, claims to be losing less than 20 cents per ton in his tailings.

It is reported that a sale of the Gue and Wilson property has been made, but no facts are made public as yet.

In General.

"The fact that Nova Scotia coal is far inferior to Pennsylvania bituminous is no reason why the tariff should be removed on Canadian coal," said Harry A. Berwind, of the Berwind-White Coal Mining Company, recently, in speaking of Senator Sherman's reciprocity scheme. "The cheapness of the Canadian coal would make many people prefer it to the Pennsylvania coal without regard to the comparative value of the two, and for that reason the removal of the tariff would have some effect on the New England coal trade. Still, we don't fear the Canadian competition in the long run."—*Philadelphia Inquirer*.

The above paragraph is a very fair sample of the slip-

shod and wilful misrepresentations that are occasionally prominent in the columns of our contemporaries across the line. A gentleman very prominently identified with the coal interests of the Province, on being shown the paragraph, remarked: "There are good and bad coals in both countries, some coals better suited to one purpose, and some for others, but the writer of the paragraph in question evidently is indifferent to facts; he don't want to be set right, being content to make a political point regardless of truth."

Prof. Bailey, who has been conducting investigations during the summer in Shelburne and Queen's counties for the Geological Survey of Canada, reports the area of auriferous strata in these districts much larger than was generally believed, and predicts that important new discoveries will soon be reported from that quarter.

New Brunswick.

The Windsor Gold Mining Company, Limited, has made application for incorporation under the Joint Stock Companies Letters Patent Act, Capital \$100,000. Head Office: St. John, N.B. Directors: J. H. Harding, St. John, N.B.; W. W. Clark, St. John, N.B.; H. T. Harding, Truro; W. R. Stockbridge, Boston, Mass.; Gideon Havenor, St. John, N.B.; H. E. Hardige, Boston, Mass.

Quebec.

Eastern Townships District.

(From our own Correspondent.)

The American Asbestos Co. have placed a cable derrick in position on the hill above the main workings. This is the first derrick of this style that has been tried in the asbestos mines. By means of this derrick they are enabled to hoist the waste rock from the pits and haul it away from their openings without handling it by hand. It is a decided improvement on the boom derricks and could be used to advantage by other companies, especially those who have large pits, where it is impossible to place boom derricks to reach around to all parts. By stretching the cable across the pits loads can be lifted from any point. Their manager, L. A. Klein, has returned from an extended trip through the States.

Dr. James Reed has his plant nearly ready to run. It is expected that it will be running about October 25th. The doctor is also erecting some dwelling houses on his property for the workmen employed. Several pits are opened and are being worked with good results.

Work at the pits of the United Asbestos Co. is being carried on with good results. They have commenced taking off top rock in their large pit with a view to widening it. The bottom of this pit has been and still is very rich, but before taking any more from the bottom it was necessary to lighten the top. Several veins large, but discolored, have been struck on the top and give every indication of continuing at depth.

Work at the Anglo Canadian is going on as usual. They have taken down their large boarding house and are building smaller houses for their workmen.

Messrs. King Bros. are driving a tunnel under the railroad to reach good ground on the other side. The openings are all looking well.

The Laurier Co. are working on their lots, but we do not hear with what success.

Messrs. Walsh & Mulvena, of Sherbrooke, have done some exploring on a lot at East Broughton, near the property of the Scottish Canadian Asbestos Co. Numerous veins have been shown and it has every indication of being a good thing. Some very fine samples have also been taken from a property near Tring Station.

Capt. T. R. Davey, Harvey Hill Mines, leaves shortly for England on business.

Work at the Megantic Mines, Coleraine, has been suspended.

It was intended that the visiting members of the British Iron and Steel Institute and the German Association of Iron Smelters should have paid a visit to the Asbestos Mines in this district, the copper, smelting, chemical and fertilizing works at Capelton, the marble quarries at Marbleton and other points in the Eastern Townships, but it was found to be impossible to make any suitable arrangements that would permit the party to return to New York from Sherbrooke and it was accordingly reluctantly abandoned. The Messrs. Nichols too have no inclination to make a precedent of opening their works to visitors and refused permission to admit the visitors to their interesting and extensive works.

All the Thetford mines are working full time and making out-puts satisfactory to their owners.

Ottawa Valley.

Having completed all necessary arrangement Mr. Geo. Stewart has commenced operations at the newly acquired properties of the Phosphate Corporation, Limited. Mr. Stewart will exercise a general supervision of the mining work at the High Falls, Ross mountain and Murphy properties at each of which a force of 50 men will be at once employed. Mr. Stewart starts work on a guarantee to produce 10,000 tons of phosphate from the Ross mountain and High Falls properties, and there is no reason why his moderate anticipations should not be fully realized, both properties being most promising. The formal transfer of the properties to the corporation took place on Wednesday, 22nd, with befitting ceremonies. Mr. William Macintosh, Buckingham, will manage the Ross mountain under Mr. Stewart's direction.

Mr. O. M. Harris intimates that his exports to all points for this season will more than double his production last year. Large quantities of high test phosphate are daily being raised and shipped from the Canadian Company's pits.

It is thought that the export from the High Rock mines for this season will figure close upon 5,500 tons. About 2,000 tons of 60% ore have been exported with the higher test shipments.

Ontario.

The Standard Asbestos Company of Ontario, Limited, is the name of a new company incorporated to operate asbestos lands in the township of Elizier, County of Hastings. Authorized capital \$100,000, divided into 100 shares of value of \$100 each. Directors, Hon. J. E. Campbell, Hamilton, Ohio; D. U. Jennings, New York; F. J. Falding, Sherbrooke; R. H. Martin, New York. Head office, D. U. Jennings, secretary, 45 Broadway, New York.

Port Arthur District.

(From Our Own Correspondent.)

THE BADGER SILVER MINING COMPANY.—Your correspondent has recently visited this company's property, and through the courtesy of Superintendent Shear was shown through the various workings. The prediction made in these columns some time ago has been amply verified. The shipments have exceeded the estimate, as they are now making semi-monthly shipments of smelting ore and concentrates; each shipment consists of one carload, containing 17 tons. The "West End" vein has developed into a strong, well-defined lode having an average width of 3½ feet between the walls. The gangue is composed of calcite, zinc blende, galena, pyrites and black silver, having an average value of 150 ounces of silver to the ton of 2,000 pounds, the richest portion being along the bottom of the level, which appears to be driven over the top of a rich ore body. The breast of the level is now within a short distance of the intersection of No. 1 vein, at which point a shaft will be sunk and drifting commenced. It is also the intention to begin driving No. 1 level on No. 1 vein. When work ceased at this point last year the vein was five feet wide in the breast and carried 40 ounces of silver to the ton. At No. 2 vein, No. 1 level west from the shaft is being pushed on as fast as possible. The pay streak is 18 inches wide, the ore of which averages 1800 ounces to the ton. A winze is being sunk 175 feet east from No. 2 shaft. The vein in the winze is carrying its width down and is producing 100 ounce ore. No. 1 adit level, on No. 3 vein, is now in a total distance of 240 feet, and is in bonanza ground. The vein has a uniform width of 3 feet. The gangue is the same as at the "West End" and No. 2 veins. The ore from it is averaging from 1425 to 2140 ounces to the ton. No. 1 shaft on No. 4 vein is down 135 feet, and has been in bonanza ores for the last 65 feet. The ore on some portions of this ore body averages as high as 7,000 ounces to the ton.

SILVER ISLET CONSOLIDATED MINING AND LANDS COMPANY.—H. S. Sibley and Professor W. M. Curtice of Detroit, paid a visit this week to the Edward's Island location for the purpose of making an examination of the development work done. Their examination proved highly satisfactory; they left for home on the 14th inst. taking large samples of Arsenical silver with them. The vein is a true "fissure" averaging 3½ to 4 feet in width; it crosses a series of horn blende, porphyretic and trap dykes, every one of which it faults; it has been traced across the island, and shows up in a strong out cropping on the north point. The gangue of the vein in the shaft is composed chiefly of calcite, with some quartz and boryta, heavily mineralized with glena, blende, iron and copper pyrites and nickel; at a depth of 20 feet a seam of arsenical silver and nickel came in, and is continuing down as depth is attained. Selected samples assayed from 40 to 130 ounces of silver to the ton. A steam hoisting and pumping plant will be placed in position as

soon as the necessary buildings can be erected, Capt. Trethewey is at present engaged in opening up the company's copper property at Cape Maimaise.

THE BEAVER MINING AND MILLING COMPANY.—Extensive improvements have been made recently to the mill, four new vanners have been placed in position, three of which are the invention of the superintendent, and are doing excellent service in saving the fine silver from the slimmers. The last shipment was made on the 27th ultimo. It consisted of 17 tons of concentrates and smelting ore, valued at \$25,000. They have at the present writing 37 tons of concentrates on hand at the mill and at the C. P. R. warehouse at Murilla station.

Mr. Richard R. Paulison returned this week from a two months trip along the Bessemer Iron Range, contiguous to the Port Arthur, Duluth & Western Railway, now under active construction to the Minnesota boundary, 84 miles from Port Arthur, 40 miles of the road already having been completed this season.

Mr. Paulison also examined the vertical deposits on Hunter's Island. The most favorably known deposit of merchantable ore lies one and a half miles across the boundary in Minnesota, and consists of 160 acres of land belonging to the Milwaukee Iron Company. Commencing at the breakoff to the north, the ore lies nearly horizontal with a dip of only 5 degrees. A trench about two feet deep has been dug along the iron about 500 feet, and pits sunk passing through seven feet of ore, the top two feet of which certainly will average 67% of metallic iron, and the entire horizontal deposit produce large quantities of good shipping ore.

Two miles west from this property the Chicago Iron Company own a valuable location, and which they favourably tested last winter with a diamond drill. This range has been traced from these deposits in a north-easterly direction to the Canadian Pacific Railroad at Kaministiquia, a distance of nearly 80 miles, and on its course are located the Caldwell, Segwick and Paulison properties. The ore is distinctly different in appearance from that of the Vermilion and Hunter's Island ranges, and comes within the class of steel producing ores, and is black in colour, while the ranges immediately north carry the red and grey hematites. The entire range juts against the gneiss or so called granite overflow, and has a horizontal tendency. At the Caldwell and Segwick tracts, north of Gunflint Lake, several test pits have been put down, and prove conclusively the presence of ore in large quantities. This also applies to the thirty odd miles of deposits belonging to Mr. Paulison, north of North Aarrow and Whitefish Lakes, where the most prominent exposures of ore in place are found on 77 A., 88 A., 38 A., and numerous locations north of Round Lake. The "Wigwams" R. 257-258, in which the Sibley's, of Detroit, are interested with Mr. Paulison, have the largest body of ore in sight of any location on the range, and the essays average over 60%. Peewabic Mountain, still further to the north-east, has a good showing on its north and south face, but has not yet been thoroughly explored.

British Columbia.

At Illecillewaet the Selkirk Mining Company is running a 500-foot tunnel on the Lanark, the work being done by contract. This tunnel is expected to tap the ledge at a depth that will solve the problem.

The miners at the Union collieries, Comox, are very busy turning out good quantities of coal. The company's wharf is most favorably situated, and can accommodate as many as seven vessels at one time. The pits are turning out from 300 to 400 tons per diem.

The following are the official returns of the value of the exports of minerals from the ports of Victoria, Vancouver and Nanaimo for the three months ended 30th September:—

Minerals.	Victoria.	Vancouver.	Nanaimo.
	\$ cts.	\$ cts.	\$
Coal		18,511 00	389,116
Lime	1,061 85	1,517 50	
Stone		255 67	1,120

Returns of the value of coal exported from Nanaimo shows the following:—September, 1889, \$397,497.55; December, 1889, \$439,448.37; March, 1890, \$385,528.17; June, 1890, \$414,827; September, 1890, \$389,116.

A trial shipment of 100 tons of coal from the mines of the Canada North-West Coal Company at Canmore has been sent down by S. S. Walla to San Francisco to be tested. The H.M.S. Espeigle also Saturday, before she left the harbour, took on 25 tons, and will make a test on the coal. The result of the experiment will be sent to the Admiralty for their consideration.

McKinnon has a few men at work on the Maple Leaf, a claim adjoining the Lanark, and has five horses packing ore to the railway, for shipment to the Revelstoke smelter.

In the Hot Springs district the main subject of discussion is the success or failure of the Best patent smelter. The patentee is on the ground clearing a site for a plant of 20 tons capacity. The location selected is at the mouth of Woodbury Creek, two miles north of Ainsworth.

The pump and hoist for the Little Donald was brought in from Bute this week, and contractor Northey is now engaged in getting it up to the ground and in place.

The machinery for the Krao was ordered from Chicago some time ago; but the manufacturers made a mistake in shipping it, and a "tracer" found it down on a Southern Pacific sidetrack in Arizona. It is expected in next week.

In the Mountain District the only thing worthy of note is the ore shipments from the Silver King. Six days a week Joe Wilson's train of pack animals makes a round trip between the steamboat landing and the mine. The estimated value of the ore brought down daily is from \$1,000 to \$1,200, each sack of 100 pounds being worth \$15. The Surprise and barge transports the ore from Nelson to Bonner's Ferry making two trips a week.

At Eagle Creek, the Poorman Company is at work making preparations to start a tunnel that will tap the ledge at a depth of 300 feet. A Pelton wheel is being placed in position, and a Burleigh drill has been ordered. This company means business, and everything under taken is carried out successfully. The Royal Canadian has been examined by a number of "experts," and a deal is now said to be in progress, which, if made, will place that property in the hands of men backed up by Ontario capitalists who are not afraid to invest a few thousands in gold prospects.

Gold Mining in Australia.

Theodore West, Darlington, Eng., read before Cleveland Institute of Engineers.

The first part of this paper is descriptive of the colonies of New South Wales, Victoria, South Australia, Queensland, and West Australia, particularly with regard to their mineralogical characteristics. These colonies, the author states, are highly advanced, socially and politically, attributable mainly to the discovery of gold and other valuable minerals, as well as to the many other resources within them—the development of which affords employment for many of our surplus population.

He states that soon after the discovery of gold, nearly all the most productive spots were pitched on, specially where the metal was easily worked, and exhausted by the simplest of contrivances in the hands of men who knew little or nothing of mining or minerals.

The following is a section of the deposit in which the gold is usually found:—

On the surface is a thin layer of top soil, thin strong ferruginous sand, fine gravel, then alternating layers of sand and gravel, coarser and coarser the deeper one goes, then large pebbles, and, lastly, boulders resting on the rock. It is in the latter stratum that the largest finds were obtained, or in the chinks and holds of the bed rock. Sometimes the gravel and pebbles were naturally bedded together with clay which, on exposure to the weather, readily fell into pieces, whilst at other points it was found to be bedded hard with what was called cement, probably due to the lime, iron, or silica contained in it.

In estimating as to the probabilities of ground paying for gold working, the yield of gold per ton of material handled is only one of the elements which have to be taken into account, as it will greatly depend on whether the material is hard or soft, near the surface or requiring to be raised from a depth, wash-dirt scarce or plentiful, and a good supply of water obtainable near the site of the operations.

The process of washing the alluvial gold is next gone into and depends on the well-known theory that the heavier substances always sink to the bottom, consequently all the apparatus used in this operation is designed and constructed on the principle that, while water has the power to wash away the base material, the metal is almost entirely left behind. The processes

described and illustrated are:—(1.) By means of the "hand cradle," which is very tedious and laborious; (2) The "Tom," which better enabled poorer ground to be worked to pay than what could be done by the cradle; (3) By "sluice boxes;" (4) The "puddling machine," for clay wash-dirt; and (5) By "hydraulic sluicing," an American process, which is objectionable on account of the large amount of debris that was washed into the streams and water-course, and deposited on the low lying lands. It is stated that, as the alluvial deposits operated on were exhausted, and owing to the finding of small pieces of quartz with gold adhering to them, the attention of miners was directed to the quartz veins which were found traversing the various districts, some of them for miles. They are usually found to dip at an angle of 40°, although at times a flat-lying reef, several feet in thickness, is found extending over a considerable area, but generally poor in metal.

The veins are found to vary in colour from pure white to black; the clear white are usually barren.

In the mining of the veins, a depth of about 330 fathoms has been reached, necessitating the employment of experienced miners and the use of costly machinery and other plant for the purpose of raising the ore to the surface, and skilful application of refined chemical process, to be used for wholly extracting the gold from it.

The author gives a sketch of a ten-stamp battery used for crushing the ore, also of "Chilian Wheels," and many of the other machines in use many years ago, as well as descriptions of the various mechanical and chemical processes now in use—such as the Cassell's patent, acting on the principle of decomposition of common salt and crushed ore by galvanic action, dissolving the gold, which is filtered through asbestos cloth and precipitated; and also the MacArthur-Forest Amalgamator, by which the ore, after being firmly ground, is mixed with the cyanide of potassium stirred for 8 or 10 hours by a four-bladed propeller, then filtered through fine zinc, and deposited as a cyanide of gold.

How to Manage Steam-Engines.*

It is rather a difficult matter to write about the management and repairing of engines, as nearly all the repairs are what should be a machinist's job, as nearly all would require machine work to properly complete it, therefore it cannot be classed as a part of an engineer's business.

As regards the management of steam engines, it will be necessary to begin at the foundation, and give a minute description of the manner of setting up and adjusting work, which every engineer should understand in order that he may know what his engine needs when not doing its work properly. Every foundation for an engine requires the skill of a stone or brick mason to build, and when that is properly done then the engineer's duties begin, the first thing being to place the frame or engine bed upon the foundation, seeing that it is banded up and firmly held in its proper position. The next thing in order is to place the shaft in its bearings, seeing that it is on a proper level, and fits its bearings properly, to run easy and smooth. Then place the fly-wheel in position upon the shaft, taking care that it runs true (as it should be properly fitted when made), placing it equal distance between the shaft bearings, so that the weight will be alike on each. Next in order is the placing of the cylinder on the bed in its proper position; there should be no mistake about this, as there should be what are termed steady pins to hold it in its place.

To prove that the shaft and cylinder are properly placed, attach to the outer end of the cylinder a small piece of board, long enough to reach across its end and fastened with one of the bolts which holds the head on. Attach to this piece a fine strong cord or wire that will not break on being drawn tight, fasten on the farther end of the bed another piece of board, leaving enough to stand up as high as the center of cylinder, attach the other end of the cord to the latter piece, bringing it exactly to the center of cylinder, which can be done by calipers. Turn the fly-wheel over, bring the wrist pin to the line, and be particular that it is exactly in the center of the bearing on the pin; then reverse the fly-wheel, bring it to the line of the other center. If the line is on the center of cylinder, also on center of wrist-pin when turned on both centers, then your engine is on line; but if not then the cylinder must be out of line, or else the shaft is not square with the cylinder, in which case it must be brought to a perfect line, either by moving the cylinder, or pillow block the outer end of shaft. When these points are in a perfect line, put in the piston and attach the connecting rod to the cross-head, being sure that the cross-head comes in a perfect line with the center of cylinder.

When this is accomplished, all is ready for connecting the smaller parts, such as cut-off, rod-valve, &c. This brings us to an important part of the work, viz., the setting of the valve, of whatever kind it may be. I find this the most simple way to adjust in a slide-valve engine. Turn the fly-wheel to its furthest point, or in other words, to its center point, which will bring the piston

head to one end of cylinder; now set the valve so as to cover the port, leaving not more than 1/44th of an inch from the introduction of steam, when the crank is on its center, and see that the valve stands in the same position; if not, it may be adjusted by the length of connecting cut-off rod, until the valve stands in the same position at each central point. When this is done see that the exhaust port is clear, to relieve the cylinder of the steam at the proper time. I have seen engines set up with the valve of a length not to admit of a free exhaust, which caused the engine to work heavy.

Another important point in the arrangement of an engine is the steam feed and exhaust pipes. The rule generally adopted is, to have the exhaust pipe 1/2 inch larger than the feed pipe, but I find by experience that the exhaust should be 1 inch larger, which will cause the machine to run much freer, causing less strain than when a smaller pipe is used.

Another important point is the setting of the piston packing rings; these should be set very carefully, taking great care that the piston head is exactly in the center of the cylinder, using a pair of calipers in adjusting it.

As regards care and management of an engine, after being put in order according to the above named points, but little work is required, but it must be constantly watched and kept well lubricated in all its parts, the cylinder receiving special care. It should have a lubricator attached to the feed pipe just before it enters the cylinder, emitting two or three drops per minute, according to the load the machine is carrying, and great care must be taken with the packing rings to keep them just tight enough to prevent any leakage of steam, and not tight enough to cause any great friction.

I have found that one good qualification in an engineer is to know enough to let his machine alone when it is working well, and to know when it is doing well. I have known men in charge of machines to be constantly at work at them, and often getting them out of order instead of benefiting them.

Great care should be taken to keep all of the bearings just tight enough to run easy without any slack motion, which causes them to thump or pound at each revolution.

In setting up the keys I find it best to use a soft metal hammer, which will not bruise the end of the key. In using, hit it one blow on the point, which will give it a little back motion, just to give the bearings a free working motion.

It is the custom of many engineers to oil the cylinder three or four times per day with about one gill of oil, but this is not the proper way. A cylinder needs oil the same as any other bearing, in very small quantities and often.

Another important matter is in starting the machine. All drips should be opened and the water drained out, by letting a little steam in to warm up the cylinder before it is started, and then slow for one minute, giving it time to work off all water which has settled in it, getting it well warmed up before running at full speed.

The great point in management is to keep close watch and to know when the machine is not running right; then, if wrong, learn just what the trouble is before any changes are made, as the machine may be injured by not doing the right thing. An engineer should be a good machinist as well as a careful man, possessing good judgement, never doing repairs or making changes until he knows what is necessary to be done. If the above rules are strictly observed, very little repairs will be needed, except in case of breaks, and as to directions about repairs, no mechanic can tell just what to do until he sees just what the break is and determines its cause. Any other plan for repairs would be much like "ideal farming;" practical knowledge is the best.

*Prize article by B. Taylor, in the *Sawmill Gazette*.

Underground Pumping.

The mode of dealing with the large quantity of water often met with in sinking pits has always been a matter of great importance, because of the following obstacles which have to be overcome: First, having constantly to lower the pumps, together with a consequent lengthening of the spears or rods; second, the difficulty of keeping the valves and working barrels in order, in consequence of the quantity of solid matter which is necessarily raised with the water; and third, the difficulty of carrying on sinking work with pumping plant always at the bottom of the pit. A special form of sinking pump, recently designed by Messrs. Bailey & Co., of Salford, is now successfully at work at the Cadeby mine in South Yorkshire, and contends with the above difficulties in a very satisfactory manner. The pumps are hung in the shaft by wire cables from the surface and are easily lowered by means of powerful capstans as the sinking progresses. The special feature of this steam pump is that, instead of having an engine with foundations, connecting rod, quadrant and spears, all liable to wear and tear and mishap, the combined engine and pump is the only thing to be dealt with. Eye-bolts are provided at the top, by which it is suspended from chains or wire ropes, and

lowered to follow the falling water. The pump consists of three hollow plungers. The upper pair are stationary, and over them are sliding barrels which are connected to the steam piston. From the lower end of these barrels projects the bottom plunger, working into the third barrel, which is secured by means of connecting rods to the steam cylinder. Thus there are two smaller barrels in connection with the larger ram.

There is a group of valves in the junction between the smaller barrels and the larger ram, constituting the delivery valves; and another group of valves at the bottom of the large barrels, constituting the suction valves. The action of the pump is as follows: As the bottom plunger rises, the water follows it into the lower barrel; at the same time the water in the upper hollow plungers is forced into the rising main. In the down stroke, the water in the lower barrel is forced through the lower plunger and valves into the upper barrels and plungers, and thence into the rising main. Thus there is a continuous delivery in the up and down strokes. One of the upper plungers is open on the top and forms the discharge orifice for the water; and the other is closed, forming an air vessel, which is continuously charged with air through a suitable snifting valve fitted to the side of the pump nearest to that plunger, and below the discharge valves; this snifting valve permits a small quantity of air to be drawn in with every upstroke of the pump. The steam cylinder is fitted with the Davidson slide valve.

Six of these pumps have been supplied to the Denaby Main Colliery, which will raise 300,000 gallons per hour through 300 feet. Each pump has its own winding drum and steel wire rope, enabling each or all of the pumps to be raised or lowered at will. Two shafts are being sunk to a depth of 600 yards, and four pumps are in one shaft and two in the other. Each pump has a telescopic suction pipe, which enables a depth of nine feet to be sunk without lowering the pump.

The First American Tin Mill.

The *Rapid City Republican*, in a recent issue, gives an interesting description of the Elendale Tin Mining Company's new Tin Mill, the first of its kind established in the United States, and which is now treating the product of the Dakota Tin mines. Our contemporary states that the mill is located on Iron Creek, about 22 miles south-west of Rapid City, at the foot of the mountain on which the mines are situated. The mill proper measures 50 feet in width by 100 feet in depth, and is divided into 3 stories. It is unique in plan, compact and convenient, well built in particulars and protected from all dangers of fire, both by a system of water pipes and by having roofs, etc., covered by a thick asbestos coating. Either steam or water power may be used for running the machinery. The steam equipment consists of two 100 horse power boilers and 100 horse power high speed engine. The water power equipment consists of a flume 20 inches by 24 inches in section, bringing the water from a dam on Iron Creek, a mile and a quarter distant from the mill, giving a head 100 feet pressure at the wheel. About 500 miner's inches of water are supplied to the Turbine wheel. The water power will be used except during short cold snaps in the winter, the engine being placed in the mill as reserve power in case of accidents. The ore is hoisted from the main shaft and dumped first into an ore bin of 200 tons capacity, located high up the mountain over the hill. From this bin it is conveyed to the mill by a wire rope bucket tramway, the lode going downhill to the mill, hauling the empty buckets back to the mine. The ore buckets mechanically deliver their contents into a 175 ton ore bin, above and back of the mill. The large lumps of ore are crushed, first by a Gates crusher, then passed through a drier to a set of Gates improved cornish rolls, thence elevated to a set of rotary sizing sieves. From the sieves the finer sizes are conveyed to a set of Paradox concentrating tables, and the coarser sizes to common Hartz jigs. The concentrates are, for the present, being shipped to Chicago to be smelted, but it is the intention of the company to erect at once a smelting plant on the hills. Assays and tests from the different workings gave an average of 3 per cent. metallic tin, while picked or specimen rock is often blasted out that will yield over 30 per cent. of the white metal.

An Electric Well Oil Driller.—Wesley Webber, of Pittsburgh, has been granted a patent for a new device for drilling oil wells by electricity. The new invention is a novelty, and if a success will revolutionize the modus operandi of drilling oil wells. The device is intended to supplant the use of heavy tools and do in a scientific way that which has heretofore been accomplished in a crude way. The device, as distinguished from the power in the derrick used at present, is an apparatus comprising a series of motors in tandem, connected to one another so as to practically make one motor. The reason for using the motor in tandem is to get the power within a six-inch

diameter, so that the entire mechanism, which, to outward appearances, looks like the common boiler, can be lowered in the well and the power applied direct at the bottom, which is the true place of resistance in "making a hole." Projecting therefrom is a rod which resembles a piston-rod working in and out of the cylinder; upon said rod the drill bits are firmly fastened and the apparatus lowered in the well the usual way. The entire mechanism, with a number of improvements to adapt it to drilling, is about the same as propel the electric street car, and as a number of mechanics and electricians who have seen it say, "there is no reason why the thing won't work."

Uses of Asbestos in the Laboratory.—Asbestos in its various forms is a very useful substance, and can be employed very handily in many ways at the lecture table and in the laboratory, says Professor Markoe. Shredded or carded asbestos will serve as an excellent filtering material, used just the same as paper pulp. Asbestos twine is used in binding together parts of apparatus exposed to fire and strong acids. The professor often prevented a crack in the neck of a retort or flask from spreading by binding it with asbestos yarn or twine soaked in solution of sodium silicate, and then treated with a solution of calcium chloride, a perfectly insoluble cement being thus formed. Asbestos wool mixed with solution of silicate of sodium makes a fire-proof cement of great strength, also serves to mend cracks in stoneware. It can be made insoluble by subsequent treatment with calcium chloride, silicate of calcium being formed. Asbestos paper and card can be obtained of all degrees of thickness, and can be well employed as substitutes for wire gauze and the sand bath in small operations involving the heating of glass vessels. Asbestos paper and silicate of sodium are very useful for mending cracks in glass apparatus.

Look out for the Canadian Mining Manual, now in press.



SEALED TENDERS addressed to the undersigned and endorsed "Tender for recovering roofs of Engine, Boiler Houses, &c., Parliament and Departmental Buildings, Ottawa," will be received at this office until Friday, 31st Oct., 1890, for the several works required in recovering roofs of Engine, Boiler Houses, &c., at Parliament and Departmental Buildings, Ottawa.

Specifications can be seen at the Department of Public Works, Ottawa, on and after Thursday, 23rd October, 1890, and tenders will not be considered unless made on form supplied, and signed with the actual signatures of tenderers.

An accepted bank cheque, payable to the order of the Minister of Public Works, equal to five per cent. of amount of tender, must accompany each tender. This cheque will be forfeited if the party decline the contract, or fail to complete the work contracted for, and will be returned in case of non acceptance of tender.

The Department will not be bound to accept the lowest or any tender.

By order,
A. GOBEIL,
Secretary

Department of Public Works,
Ottawa, 18th Oct., 1890.

WANTED TO PURCHASE, AT A REASONABLE FIGURE, A good Asbestos Property.

None but principals dealt with.

Address, WITNESS OFFICE,
MONTREAL.

The Canadian Mining Review

CONDUCTED BY . . . B. T. A. BELL

OFFICES:

UNION CHAMBERS, 14 METCALFE ST.,
OTTAWA.

Vol. IX. NOVEMBER, 1890. No. 11

PUBLISHED ON THE 25th OF EACH MONTH.

SUBSCRIPTION RATES.

ONE YEAR (in advance) \$2.00
SIX MONTHS..... 1.00
SINGLE COPY15
BRITISH AND EUROPEAN (post paid)..... 2.00

ADVERTISING RATES.

SPACE.	ONE MONTH.	THREE MONTHS.	SIX MONTHS.	TWELVE MONTHS.
One Page.....	\$30.00	\$70.00	\$130.00	\$250.00
One-Half Page...	20.00	40.00	70.00	130.00
One-quarter Page..	10.00	25.00	40.00	75.00
One-Eighth Page..	8.00	15.00	25.00	40.00

Professional and Business Cards.

Advertisements under this head inserted at the rate of \$15.00 per year per inch.

Want Column.

Fifteen cents per line; no advertisement to occupy less than two lines. Orders for this column, and for all transient advertisements, must be accompanied by cash.

Remittances.

Remittances should always be made by Bank Drafts, Cheques or Post Office Orders, made payable to the Manager. American Postage Stamps are of no use to us whatever, and will not be accepted in payment of small amounts.

Co-Operation Invited.

The publishers earnestly request the co-operation of readers of the REVIEW for information, communications that can be utilized, suggestions, news items, etc., etc. All such should be addressed to the Editor.

The Proposed Mining Tax.

The Lieut.-Governor of the Province of Quebec has intimated in the speech from the throne, at the opening of the present session of the Legislature, that among the proposed means for raising revenues is the imposition of a tax upon the mining industries of the Province.

We have repeatedly in these columns expressed the opinion that the true method of dealing with mining lands is to lease them on royalty, with compulsion of operation, or failing that, the forfeiture of the lease. This would put an end to the locking-up of valuable lands by speculators, would give the prospector and discoverer a chance of profiting by his enterprise, and would greatly add to the revenue of the Province. The monopoly and control of our mineral lands by men who have no intention of doing mining work themselves, and whose only effort is to "unload" the properties upon others at exorbitant prices, has become a crying evil, and we call upon the Government to put a stop to it. Henceforth let any applicant, with guarantees of continuous working, have the privilege of mining on Government land, paying a royalty on the output. The present system tends greatly to prevent the operation of mines, because the first purchasers being mainly speculators (often government officials who are able to pull wires

and get favorable grants), sell the lands at prohibitive prices; and many investors who would be willing to risk their capital in actual mining operations, will not pay in advance a large sum for the privilege of what is well known to be a hazardous risk. Men need to be *coaxed* into mining more than into any other industry; for though its profits are often large it has a great percentage of losses. It is stated in Chambers' Encyclopædia that 92 per cent. of the mining capital of the United States has been sunk. The great prizes occasionally won in that country have overcome this discouragement, and venturesome men still invest. But in the Province of Quebec our mines have not had time to yield but few brilliant results; there have been no great successes such as to tempt a large influx of capital, and it requires the most judicious consideration and every possible offer of inducement on the part of the Government to prevail upon capitalists to undertake mining ventures. Even if these fail to be profitable to the investors the money expended goes to the toilers of the country, and is of incalculable benefit in those regions now, unfortunately, so widely spread, where farming has become unprofitable or the lumbering business has declined. The mining industry is not one that is making such profits on the average that it can bear to be taxed. It has accumulated no gains by the fostering hand of government through a protective tariff, and owes no acknowledgement for favors received. On the contrary, the privileges given by government to manufacturers have operated in every respect adversely to the mining interest, increasing their expenses in every direction without the least compensatory return. If any single branch of trade is to be selected to bear a special burden of taxation let it be that which has been most fostered at the expense of the community. Let not the tax fall upon the one almost sole manly industry of Canada that is struggling unaided to its feet, and asks no privilege but "a fair field and no favors!" A tax on mines, coming in addition to the high prices demanded by present owners of mineral lands, would operate as a fatal blow to many prospective enterprises, and would prove to be in some cases the last straw that breaks the back of a struggling industry.

It is hardly in our province to proclaim schemes of political economy, but upon general principles we must condemn special taxation upon individual industries and demand that taxation, which is made presumably for the good of all shall be so levied as to be paid by all in some sort of equitable proportion to their means and privileges. A tax on all land values would more nearly approach to ideal equity, or a tax on incomes, though irksome and difficult, would be in the direction of justice. The Government having sold its lands for the greater part outright, would be guilty of breach of faith if it now demands further payments; and in the cases of late sales, where the possibility of taxation was intimated, assurance having been given by legal enactment that this res-

triction would not be enforced for a given period, a feeling was created that the Government was opposed in principle to such taxation and investment has been made in confidence that such a liberal policy would be continued. If any tax is to be levied we would suggest that it should be placed upon the mineral lands held in idleness by speculators; then they would either go to work or else abandon the lands, and in the latter case they could be leased on royalty to bona fide miners. Let industry be untaxed, but let monopoly, idleness and special privilege be made to pay richly for their usurpation of natural opportunities which ought to be ever fully available to all willing workers. The more mining is prosecuted the greater is the chance of discovery. Venturesome capitalists dared to pursue the dubious production of copper at Sudbury, and were unexpectedly rewarded by the discovery of nickel. For the interests of the country therefore we say,—Hands off from every struggling industry and let not the parent be the one to heap unnecessary burdens upon the child!

Another Bluff.

In another place our readers will find the full text of Mr. S. J. Ritchie's Memorandum to the Canadian Government praying for a liberal bonus to the Central Ontario Railway. Without commenting upon a proposition of so much magnitude, one cannot help comparing these, his latest utterances, with the promises so glibly given a few months ago to the Ways and Means Committee of the U. S. House of Representatives. On that occasion, Mr. Ritchie was prepared, in the event of the duty being removed from imports into the United States of nickel ore and matte, to utilize the natural gas of Findlay, Ohio, for the manufacture and treatment of his ores, indeed, he said, "we are contemplating bringing in all our ores to that place to be smelted." In the face of these contradictory statements we are compelled to accept with caution the very glowing promises he now booms out before the public. As a matter of public policy, the Montreal *Gazette* hits the nail squarely on the head, when it says:—

"We recognize and appreciate the immense value of our undeveloped, unused resources, but if the development can come only through government backing, then, by all means let the Government stand to reap the profit of the investment as well as the loss. Mr. Ritchie denies that his enterprise is a private and individual one, but surely this is a most transparent quibble! Other person may put money in the venture and so make the interest that of a community of shareholders, but none the less the public phase is wanting. And where is the line to be drawn? There are iron, silver, gold, coal, petroleum and other mineral deposits in various parts of Canada; is public money to stand behind private interest in the development of these resources? If not, why not, under the reasoning of Mr. Ritchie. Or is an exception to be made in his favour because he is an American citizen, who co-operates with the most gigantic monopoly in the United States, and has more than ordinary assurance in pressing for favours? The Sudbury mines are either valuable or worthless. If the latter, then the Government would be guilty of squandering public funds in using the receipts of customs to back up Mr. Ritchie; but if the former then the merit of the deposits should secure all the capital required. We fear our Ohio friend has been trying to play it on the Government, forgetful of the fact that a country may be young without being green."

Mineral Production in 1889.

The Annual Report, published under direction of the Division of Mineral Statistics and Mines, has been issued to the public. From these official returns we learn that there has been an increase over the year 1888 of three million dollars in the value of the minerals raised last year. Mr. Ingall is to be congratulated on the greatly improved compilation of this valuable volume, which contains a number of new features, greatly enhancing its utility as a handy reference book.

The following summary of the mineral production in 1889 is reproduced from the work:—

Product.	Quantity.	Value.	Compared with 1888.(a)
Antimony ore, tons.....	55	\$ 1,100	Decrease.
Asbestos, tons.....	6,113	426,554	Increase.
*Bricks, thousands.....	200,561	1,273,884	do
*Building Stone, cub. yds.	341,337	913,691	do
Cement, bbls.....	90,474	69,790	do
Charcoal, bush.....	1,593,300	93,463	do
Coal, tons.....	2,719,478	5,584,182	do
Coke, tons.....	54,539	155,043	do
Copper (fine, contained in ore), lbs.....	6,809,752	885,424	do
Fertilizers, tons.....	775	26,606	do
Fire Clay, tons.....	400	4,800	do
Flagstones, sq. feet.....	14,000	1,400	Decrease.
Glass and Glassware.....		150,000	do
Gold, ozs.....	72,328	1,295,159	Increase.
Granite, tons.....	10,197	79,624	Decrease.
Graphite, tons.....	242	3,160	Increase.
Grindstones, tons.....	3,404	30,863	Decrease.
Gypsum, tons.....	213,273	205,108	Increase.
*Iron, tons.....	73,231	2,763,062	do
Iron Ore.....	84,181	151,640	Decrease.
Lead (fine, contained in ore), lbs.....	165,100	6,604	do
*Lime, bush.....	2,948,249	362,848	Increase.
Limestone for flux, tons.....	22,122	21,909	do
Manganese Ore, tons.....	1,455	32,737	Decrease.
Marble, tons.....	980	980	do
Mica (exports of cut and crude, lbs.....)	36,529	28,718	Increase.
Mineral Paints, tons.....	794	15,280	do
Mineral Water, galls.....	424,600	37,360	do
*Miscellaneous clay products.....		239,385	Decrease.
Moulding Sand, tons.....	170	850	Increase.
Petroleum, bbls.....	639,591	612,101	Decrease.
Phosphate, tons.....	30,988	316,662	Increase.
Pig Iron.....	25,921	499,872	do
Platinum, ozs.....	1,000	3,500	Decrease.
Pyrites, tons.....	72,225	307,292	Increase.
Salt, tons.....	32,832	129,547	Decrease.
Sand and Gravel (exports) tons.....	283,044	52,647	Increase.
Silver, ozs.....	383,318	343,848	Decrease.
Slate, tons.....	6,935	119,160	Increase.
Soapstone, tons.....	195	1,170	do
*Steel, tons.....	27,873	973,282	do
Sulphuric Acid, lbs.....	10,998,713	152,592	do
*Tiles, thousands.....	10,526	134,265	do
Estimated value of mineral products not returned (principally nickel, iron and structural materials).....		992,838	
Total.....		\$19,500,000	Increase.
Total, 1888.....		16,500,000	

* Incomplete.

(a) Comparison of values only.

A Curious Blunder.

Much merriment has been caused among the miners of the Eastern Townships by the publication of the following remarkable news item in a recent issue of the *Engineering and Mining Journal*:—

"SCOTTISH CANADIAN ASBESTOS COMPANY, LIMITED.—The mines belonging to this company are equipped with seven air compressors, rock breakers, cornish rolls, revolving picking tables, screens, etc. About 2,000 men and boys are worked by the company. Last year 6,000 tons of ore were mined; the amount this year will be over 7,000 tons. Some of it sells as high as \$200 per ton; the average price for the year is from \$125 to \$150 per ton."

As our readers are aware this company has been in liquidation for a number of years, and

is not now in active operation. The item probably has reference to the asbestos industry in general, and has evidently been badly "mixed" through ignorance of the district worked.

Visit of the Iron and Steel Institute of Great Britain to Canada.

The recent visit to Canada of the Iron and Steel Institute of Great Britain is one which, taken in connection with the several excursions with which it has been associated, should be of the greatest importance not only to mining, but to the iron and steel industries of the provinces visited. The time at the disposal of the party was unfortunately limited to a week, and it was therefore totally impossible to show the visitors in this time, even a small portion of our industrial, commercial and mining industries. Still, it is hoped, sufficient has been done to give the visitors some slight impression of the growing importance of Canada, as a promising field for the judicious investment of capital. We can heartily re-echo the wish, so often expressed during their journeyings among us, that at some not very distant day, a full Meeting of the Institute may be held in one of our large industrial centres, when, with more time at its disposal, a better opportunity would be afforded of gaining a more thorough and comprehensive idea of the mineral, agricultural, industrial and commercial resources of the Dominion.

At Niagara.

The party, numbering some 200 ladies and gentlemen, arrived in Niagara Falls, Ont., at noon on Tuesday, 28th October. Of these, one hundred and twenty-five had signified their intention of taking part in the series of excursions provided by the Dominion Government; the remainder only desired to see the Falls and would return direct to New York.

The visitors were met at the station by Dr. A. R. C. Selwyn, Director of the Geological Survey of Canada, Mr. H. B. Small, Secretary to the Department of Agriculture, Mr. Thos. MacFarlane, F.R.S.C., Dominion Analyst, and Mr. B. T. A. Bell, Editor of the CANADIAN MINING REVIEW, these gentlemen acting as the Canadian Reception Committee, on behalf of Her Majesty's Privy Council, whose guests the visitors were to be. The party was accommodated at the Clifton House. After luncheon, the visitors divided into parties, and spent the remainder of the day viewing the wonders of the great Niagara, and in visiting the many scenic beauties on both sides of the famous old river. The glory and majesty of Niagara will doubtless linger long in the memory of the members of this party; but we venture to predict they will also carry home with them a very vivid, and perhaps more lasting impression of her hotel bills, cabmen's hires, toll dues and other extortions imposed on a colossal scale, only equalled by the great Falls themselves. A prominent member of the Institute gives it as his opinion: "I have travelled much and been occasionally extortionately charged, but never have I come across such wholesale extortion as was perpetrated on this party." A very fair idea of the shameful and scandalous nature of the extortion practised on members of the Institute, may be gathered from the following experience of one of their number:—

"As guests had to leave early on Wednesday morning I thought it wise to pay my bill overnight, and, being hurried, did not much question items. I should mention that my wife and daughter remained at the Clifton House until the afternoon of Wednesday, consequently taking luncheon. They are represented on the bill as one day, dinner, two persons, \$13. Finding great dissatisfaction expressed by my fellow-travellers at the varied extortions practiced on them, I, early next morning, asked at the office what was the \$3 item for, and was told it was for placing a cot in my room for one of the Canadian committee who had most kindly given up his room to two guests, who, no doubt, paid for it, as did the gentleman himself as his bill, room No. 106, shows.

"On my remonstrating at such a charge as \$3 for an extra cot in a room already paid for, I was told that it was correct and no deduction would be made. Consequently No. 106 must have paid some \$5 to the Clifton house for a simple cot in addition to his food, which would then stand at \$5.50, the total bill being \$7.50.

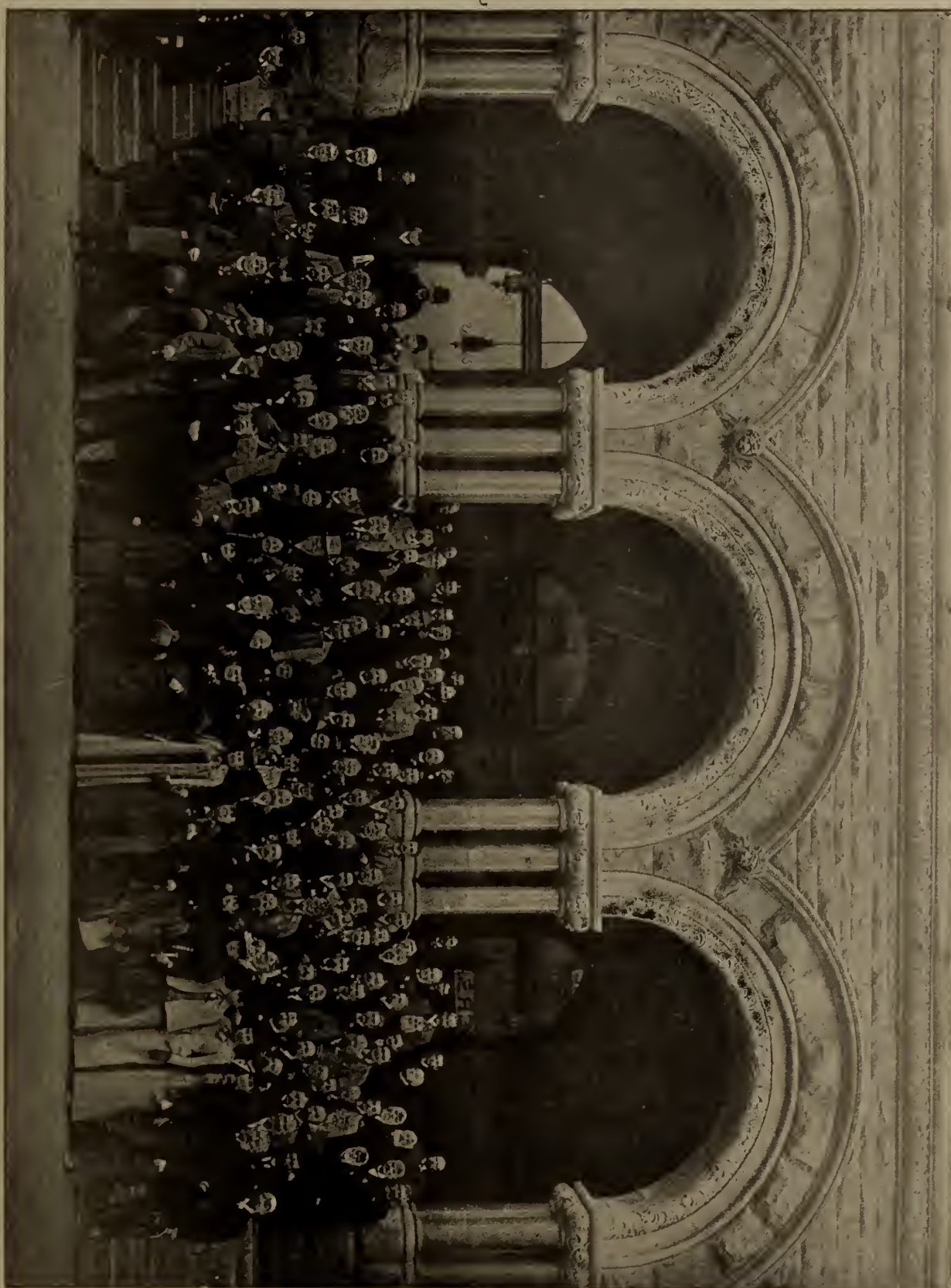
"It will be noticed that the baggage, etc., charge of \$2.50 was only to depot, and the baggage consisted of only one piece, a portmanteau, the other baggage having been expressed from Washington to New York."

The following members of the Institute left Niagara at nine o'clock in the morning of Wednesday, 29th October, on the Canadian excursion: James Allan, Coatbridge, Scotland; Charles Bell, Stirling, Scotland; Sir James Bain, Glasgow, Scotland; A. C. Bamlett, Thirsk, Eng.; Mr. and Mrs. Bantock, Wolverhampton, Eng.; Isaac Butler, Newport, Eng.; A. R. Byles, Bradford, Eng.; Mr. and Mrs. Thomas Cook, Sheffield, Eng.; J. H. Coghlan, Leeds, Eng.; W. Colquhoun, Tredegar, Wales; Mr. H. S. Craggs, and the Misses Craggs, Middlesboro-on-Tees, Eng.; Herr A. Diechman, Berlin, Germany; Mr. and Mrs. Dickinson, Wolverhampton, Eng.; Mr. and Mrs. Drummond, Bradford, Eng.; A. H. Dunnachie, Glasgow; Mr. and Mrs. Evans, Lanelley, Wales; Mr. and Mrs. Ellison, Worthington; W. Farnmouth, Swindon; S. F. Fellowees, Wolverhampton; A. Goldbach, New York; Joseph Gregory, Manchester; G. K. Harrison and Miss Harrison, Stourbridge; J. F. Hobson, Durham; Herr Hoffer, Genoa, Italy; Howat, Mr. and Mrs., Glasgow; Col. Holland, C.B., Tunbridge Wells; Prof. and Mrs. Huntingdon, London; W. T. and Mrs. Jackson, Burton; J. S. Jeans, London; Walter Jenks, Wolverhampton; James Johnstone, Manchester; W. H. and Miss Jones, Rotherham; Col. Kearsley, Ripon; F. R. Loeber, Leeds; R. Laybourne, Newport; J. F. Maclaren, Glasgow; Herr Marburg, Wiesbaden, Germany; B. Marsden, Manchester; C. Marsten, Wolverhampton; S. Vaughan Morgan, London; Miss Moss, London; A. Muir, Manchester; J. N. Muller, Middlesborough; Gerald R. Oakes, Derby; F. Oakes, Middlesborough; J. F. Pease, London; J. W. Perkins, London; W. D. Phillips, Aberdare, Charles Phillips, Newport; Edward Porritt, London; H. G. Powell, Wolverhampton; Joseph Richardson, Stockton-on-Tees; J. C. Ridley, Newcastle; F. H. Rummles, London; M. Salter, Bradford; Herr Siebel, Dusseldorf, Germany; J. Simpson, Whitehaven; Mr. and Mrs. Service, Glasgow; G. J. Smith, Sheffield; Mr. and Mrs. and Miss Snelus, London; Mr. and Mrs. Sparrow, Wolverhampton; J. C. Tannett, Leeds; J. L. Thomas, Aberdare, South Wales; F. Thomas, Sydbrook; W. H. Walker, Sheffield; F. C. Wilson, Alston; S. W. Wilson, Alston; E. B. Wilkinson, Port Henry, N.Y.; J. M. Bruce, Melbourne, Australia; H. Banks, Wolverhampton.

At Hamilton.

The special train arrived at Hamilton at 10:30 a.m., the visitors being met at the station by the Mayor and members of the City Council, the President and members of the Board of Trade and other corporate bodies. After the leading members of the party had been introduced, the visitors were escorted to the carriages in waiting, and then driven through the principal streets, visiting the leading industrial establishments, the principal public buildings, and other points of interest in and around this enterprising and progressive city. A drizzling rain was falling when the party started from the station, compelling the use of closed carriages, but at the top of the mountain, the weather, fortunately, cleared, and permitted a delightful view of the lake and city, and the fine stretch of cultivated country lying beyond. On returning to the city an opportunity was given of witnessing some very creditable movements by the fire brigade, after which the party adjourned to the Arcade Hall for luncheon. The hall was beautifully decorated with flags, flowers, and evergreens. About 250 persons were at the tables. Mayor McLellan presided. After ample justice had been done to an excellent menu, a short toast list was proposed. In proposing "The Queen," the Mayor said: "It is a toast that is always received in Canada with hearty goodwill, and it would no doubt be so received on this occasion, both by British and German delegates. When the Queen's name is mentioned, 'not only Canadians, but Americans also, receive it with every mark of respect.'" The toast was received with ringing cheers, again and again renewed, and the National Anthem was sung with great heartiness. His Worship then extended to the visitors a hearty welcome to the city of Hamilton, stating that it was greatly to be regretted that their stay was not longer and that the weather was not more propitious. He trusted that their impressions of Hamilton would be favorable. (Hear, hear.) He then proposed the health of the Iron and Steel Institute of Great Britain. The toast was received with great enthusiasm. Mr. Snelus, in responding, said that the members of the Institute had been received in Hamilton with real brotherly love, and their kindly and hearty reception would not soon be forgotten. "We have seen to-day," he said, "a community of 50,000 people where not long ago existed a wilderness; and this community is not dependent on any one industry, but many diversified industries, for its prosperity. It is indeed a remarkable development."

Mr. Adam Brown, M.P., said the remarks of the last speaker were most encouraging and spoke well for Canada's future. Together with his colleague, Mr. McKay, he welcomed the delegates, on behalf of the Parliament of Canada, to the first important point they had visited in the Dominion. Pointing to the British flags which adorned the walls, Mr. Brown said that if the delegates wished to find evidence of the devotion of Canadians to the British Empire, let them look around. (Immense applause.) Mr. Brown then proposed the health of the German visitors. "He did so," he said "With the more pleasure, because some of the most valuable and



THE IRON AND STEEL INSTITUTE AT HAMILTON: A PHOTOGRAPH TAKEN ON THE STEPS OF THE CITY HALL.

prosperous citizens of Hamilton were Germans, who had come back from the old land to make their homes in this new country, where the difficulties and feuds of the old lands are forgotten."

Mr. Thomas Macfarlane, F.R.S.C., replied for the German visitors, and in doing so, remarked that the Germans and British were natural allies—allied in blood and kinship—and they would always stand together in the foreground of civilization. Sir James Bain, ex-Lord Provost, of the city of Glasgow, proposed "The Mayor," remarking that they had met with much kindness in America, but nothing like the fraternal feeling that had been shown in Canada under the British flag. "It was something the delegates would never forget." Mayor McLellan gracefully acknowledged the toast. The proceedings were brought to a close with "Auld Lang Syne," sung with great heartiness. At the City Hall the visitors were photographed; a reproduction of the group will be found in this issue. The party then left by special train for Toronto, which was reached at four o'clock in the afternoon.

In Toronto.

The party was met at the Union station by carriages and driven to a reception given in its honour at Government House. The guests were received and welcomed by Sir Alexander Campbell and his daughter, Miss Marjorie Campbell, in the large drawing room. A very large number of the prominent citizens of Toronto were present on invitation to meet the visitors, and a very pleasant couple of hours were spent enjoying the Lieutenant-Governor's hospitality. It was originally intended that the party should remain at least a day in the Queen city, but no satisfactory arrangement could be made by the Board of Trade or the City Council before the city of Hamilton came forward with its offer to receive their visitors. After leaving Government House the party had dinner at the Queen's, thereafter leaving at nine o'clock by Grand Trunk special train, consisting of four Pullman sleeping cars, for Sudbury via North Bay.

Wearied with the day's travel and pleasures, the visitors were soon snugly ensconced in their berths, and very few of them were about when North Bay was reached early in the morning. Up to this point progress had been somewhat slow, and the special was behind her scheduled time, but here C. P. R. Divisional Superintendent Bury took charge, and ran the 80 miles between North Bay and Sudbury in an hour and forty minutes. The road bed in this division is in magnificent condition, and to show the English and German visitors what could be done on a Canadian road, one section of 35 miles was covered in 32 minutes, and this without the slightest inconvenience to the passengers.

At Sudbury Mines.

The lively little town of Sudbury was found to be *en fete*. As the train drew up to the station platform at eight o'clock the town brass band played a stirring welcome. A reception committee of the leading citizens was in attendance, and escorted the visitors to the hotels. After breakfast, which had thoughtfully been provided by the local committee, the visitors assembled at the White House hotel, where Reeve Fournier, on behalf of the citizens of Sudbury, read the following address:—

LADIES AND GENTLEMEN OF THE VISITING ASSOCIATION,—We, the citizens of Sudbury, beg to tender you a hearty welcome to our midst, and trust that your visit to this region will be one of interest and pleasure to all. We will endeavor to entertain you to advantage, and trust you will leave us with the importance of our mineral wealth, especially in the product of nickel, vividly impressed upon your memories. We have, within a radius of 60 miles a supply of the mineral of the day, nickel, in sight that will probably furnish all requirements of the mercantile world for this and the coming generation. We understand and fully realize the fact that you must now be very much bored by the repetition of addresses which have undoubtedly been presented to you in this and our great and adjoining cousins' country, the United States, and for this reason will draw our address to a close by again, ladies and gentlemen, tendering you a hearty welcome.

Mr. J. S. Jeans, Secretary of the Institute, and Mr. James Richardson, Stockton-on-Tees, suitably replied. The visitors then took train and visited the mines and works recently opened by the H. H. Vivian Co. of Swansea. After these had been carefully inspected, the visitors took the cars and were quickly run out to Blezard, to the workings of the Dominion Mineral Company.

The mine, buildings, machinery, plant, smelters and surface equipment were very carefully inspected, and many favorable comments passed thereon. Nearly the whole party then descended the main shaft to a depth of 100 feet, and examined the methods of extracting the ore. These are the first and only mines in Canada using electric light below ground. About 300 men are employed. In the afternoon the party took a run out to the Copper Cliff, and the other large mines and works owned and operated by the Canadian Copper Company. A very pleasant and profitable time was spent here, the party

being conducted over the properties by Mr. Evans, the courteous manager of the company. The party returned to Sudbury a little after dark well pleased with their outing, and loud in their praise of the many courtesies extended to them by the members of the local Reception Committee and the managers and officials at the various mines. At eight o'clock a parting cheer was given to their kind hosts, and the Special steamed *en route* for the Capital.

Entertainment at Ottawa.

The train was timed to reach the Capital before eight o'clock on Friday morning and no little surprise was therefore manifested when the party found themselves in the depot a couple of hours in advance of this time. Carriages had been thoughtfully provided by the Citizens' Committee, and in these the visitors were rapidly driven to the Russell House, their headquarters during their stay in the Capital.

The programme for the day commenced with a visit to the City Hall, where the visitors were received by Mayor Erratt and the members of the City Council. Sir Adolphe Caron from the dais addressed them, welcoming them to the Capital of the Dominion on behalf of the Government. He said it gave Canadians very great pleasure indeed to receive as visitors the representatives of those works which have made the wealth and prosperity of the nations to which they belong. He could only say, as a Canadian, we could not show Canada too often to those who wished to visit her shores.

The Mayor then read an address, in which the pleasure of the people of Ottawa that the members of the Institute had made Ottawa one of their places of call was expressed. It went on as follows:—

"We recognize in your presence the fact that the mineral resources of Canada are more largely engaging the attention of the capitalists of the Mother Countries, a fact which indicates that the time has come for the development of the valuable fields for enterprise existing in our country. We feel convinced that the practical development of the iron and other mines of the Dominion will not only stimulate industry and increase the general prosperity here, but will also prove a certain source of profit as well as gratification to the capitalists of Great Britain and the European Continent, who will find here fields of promising enterprise, equal, if not superior, to what can be found in any land. We welcome you as citizens from across the Atlantic, regardless of your nationality, and as men engaged with ourselves in the great work of national development and moral and material progress."

Mr. Snelus replied on behalf of the association. He could not express too strongly the pleasure and surprise that their visit to Canada had afforded them. As representatives from the Old Country it gave them very great pleasure to see one of her children doing so well. They had visited Hamilton, and that great city Toronto. They had seen a little of Ottawa, and had been surprised at the magnificent buildings of which they had a glimpse. This visit would do more to cement the friendship between England and Canada than any amount of literature. They wanted to know each other better. He hoped that many would make a more extended visit, as he intended to do himself. He hoped that some would do as he had done, and take an interest in the country. He believed that they could trust Canadians as brothers to take care of moneys entrusted them. (Loud applause.)

A number of the members were then introduced to the Ministers and others. An inspection of the fire brigade followed, and at two o'clock carriages were taken by the whole party, who started on a tour of the points of interest in and around the capital, the industries about the Chaudiere engrossing most of the time of the sight-seers.

In the evening the members of the Institute attended a dance given in their honour in the Russell House. About seven hundred ladies and gentlemen were present, and dancing was kept up spiritedly until an early in the morning.

Reception and Luncheon.

During the forenoon the members were free to spend their time as they pleased, and in small parties visits were made to the Museum and Offices of the Geological Survey, the Parliament Buildings, Fisheries Exhibit, Art Galleries, and other points of interest.

By one o'clock all had got back to the Russell House, and shortly after that hour his Excellency Lord Stanley of Preston and Lady Stanley arrived. They held a reception in the parlor of the hotel. Sir John and Lady Macdonald, Sir John and Lady Thompson, Sir Adolphe Caron, Mr. Foster, Mr. Mackenzie Bowell and Mr. Carling surrounded their Excellencies, and introduced the ladies and gentlemen. This was one of the pleasant events in the series, all stiffness and formality being banished and the greatest good feeling and free interchange of conversation being indulged in.

The party then proceeded to the luncheon-room. His Excellency presided, having on his right Vice-President Snelus, who had escorted Lady Stanley to the room, Lady Macdonald sat on his left, having been escorted in by Colonel Holland, a famous British soldier

and traveller. The vice-presidents were Sheriff Sweetland, Sir Adolphe Caron, John Carling, C. H. Mackintosh, M.P., Honore Robillard, M.P., Mayor Erratt. The room presented a very brilliant appearance, having been handsomely decorated for the occasion. The *menu* was *recherche*, and a host of skilled waiters served the dishes deftly and perfectly.

After the good things had been disposed of, Lord Stanley arose and proposed the first toast, "The Queen," adding a few graceful words with respect to the position she holds in the hearts of her subjects. On rising to propose the second toast, he reminded the company that their guests were compelled to catch a train and therefore his remarks would be necessarily brief. There was one thing he said that Canadians desired to excel in, and that was the art of hospitality. Therefore it was with feelings of regret that they felt that they had to part with their newly made friends that day. They owed their friends across the line a good many benefits conferred. Perhaps Canadians do not always recognize and acknowledge these benefits, but they recognized the privilege which had been afforded them to-day through our American friends inviting the members of the Iron and Steel Institute of Great Britain and the German Association of Smelters to cross the ocean. It was not his place to speak of technical subjects before a body like this, but it would not perhaps be improper of him to allude to Canada's great mineral wealth, only requiring capital and skill to develop. Perhaps some of our neighbors thought that our resources were not developed as rapidly as they should be, but if their progress was somewhat slow it was solid and sure. Their future was certain, though perhaps not immediate. Their guests had probably seen the vast possibilities of production in the Sudbury region, and he could not but regard it as a fortunate accident that brought them to Canada's doors. He regretted that their stay had been so short, that they had not seen Nova Scotia's wealth of coal and gold, or the mineral riches of the Rocky Mountains. He welcomed also their German cousins, and concluded by expressing a hope that they would soon visit us again and stay longer.

Mr. Snelus, vice-president of the Institute, replied on behalf the visitors, thanking their hosts for their princely hospitality. They certainly would not regret their visit to the Dominion of Canada. He personally, and on behalf of the members of both associations, thanked Sheriff Sweetland, Dr. Selwyn, Mr. B. T. A. Bell, the Mayor, and ex-Mayor Macleod Stewart, for their unremitting kindness and attention. He and his colleagues had learned a great deal in this visit. Some eighteen months ago it was supposed that nickel was a rare production of nature, but the discoveries at Sudbury had revolutionized everything in the nickel world. They were glad and proud that their young daughter Canada had such a magnificent inheritance of metallic wealth. A friend of his in Alabama had said in reference to the mineral wealth of that State that when Dame Nature was distributing her blessings over the earth she let loose her apron strings when she came over Alabama. It seemed to him, however, that the place where the Dame had lost her hold of her apron strings was when she was over the Dominion of Canada. There she had dropped her heavy and rich ores—gold and silver and rich metals. An inspection of the Geological Museum proves how rich beyond measure she is. She had all the metals of value, beginning with gold and finishing with iron, and all the metals between these two. Then she had fuel which was so indispensable. There must be a great future for such a country. He spoke of the family feeling that existed between the Mother Country and her colonies, and recalled that Canadian boatmen piloted British troops past the dangers of the Nile. If any peril threatened the old land he knew they could look with confidence for assistance from Canadians. He concluded by proposing the toast of the Dominion of Canada, coupled with the name of Sir John Macdonald.

Sir John Macdonald on rising was received with a perfect storm of applause, in which the ladies joined very enthusiastically. He said the near approach of the hour for departure precluded his making a speech, even if he desired to do so, but fortunately those who preceded him made it unnecessary that he should do so. It was pleasant to hear their country praised by gentlemen who spoke with such authority as did their guests, and he expressed his great regret that they had to hurry away so soon. He thanked them for their kind reception of his name.

Sheriff Sweetland proposed the health of the Governor General, to which His Excellency replied very briefly. He particularly commended the social departure by which the ladies were able to be partakers of their pleasure on that occasion.

As arrangements had been made to leave for Montreal at half past four o'clock, and as but little time remained, a most successful banquet was thus somewhat hurriedly terminated, though not before ringing cheers had been given for the Queen, Lord Stanley and Sir John Macdonald. Prompt to the minute the special train steamed out of the

Canada Atlantic station amid a volley of small torpedoes, and many hearty cheers and counter cheers from the large crowd of citizens that had assembled to witness their departure and to wish them God-speed. At Vaudreuil the train made its only stop to allow acting Mayor Hurteau, Col. Stevenson, Aldermen Clendinning, Rolland, Villeneuve and others from Montreal, to enter the train and extend a hearty welcome to Canada's industrial metropolis.

At Montreal.

At 7.15 p.m. the Special rolled into Bonaventure depot, and the members were soon being driven in the carriages provided by the city, to the Windsor Hotel. During the evening Sir Donald Smith, Sir William Dawson, Sir Joseph Hickson, and many other prominent citizens called in at the hotel to welcome the members to Montreal. On Sunday, like all good people, the party went to church, the majority being present in the evening at a special musical service in the Church of the Gesu.

The visitors were early astir on Monday morning. About eight o'clock the civic committee arrived, and the party, embarking in carriages, set out for the Grand Trunk workshops, where they were received by Sir Joseph Hickson and Messrs. Edgar and Powell, who showed them through the works. A special train was taken at the Wellington Street crossing, and the party went through the Victoria bridge, stopping in the middle to examine it. The carriages were again taken at the Wellington street crossing and the party drove to the Canadian Pacific shops, arriving there after the noon hour when the men were all away from work. The inspection here was brief, and then McGill College was visited, a short time being spent in examining the Redpath museum, and the other interesting features of this excellent institution. Sir William Dawson and Sir Donald Smith received the visitors. This ended the morning's sightseeing, and the party drove to the Windsor for luncheon.

In the afternoon the party drove around the mountain. A start was made from the Windsor at half-past two, the route taken being along Dorchester Street to Fort, and up that street to St. Catharine. Here Ald. Clendinning led the party astray, going westward instead of east, but the mistake was rectified and the party drove up St. Mark to the Montreal College. The drive was along Sherbrooke Street and up Park Avenue to the mountain road. Half way up Mr. McGibbon, the Park Ranger, met the party and guided them the remainder of the way. It began to snow in a faint weak-hearted way. Nobody minded it. People who had wraps made themselves as comfortable as they could and people who had not wished that they had, and shivered. Then a mounted policeman was met. He was a very nice looking policeman and, moreover, he looked warm. This was the most cheering sight that had yet been seen. When the Look-out was reached everybody got out. The visitors were cold and didn't try to disguise it. The aldermen were also cold, but they endeavoured to hide the fact and maintained that it was not a very cold day. After admiring the view and buying a few souvenirs, the carriages were again entered and the descent begun. Several more warm looking mounted policemen were passed, in fact so many that the suspicions of some of the visitors were aroused, and they discovered that it was the same man, who had made short cuts and headed off the party in time to recover his statuesque position before the party again appeared. The further down the mountain the party got the warmer they felt, and when at last the Windsor was reached nearly everybody had made a start towards getting thawed out. It was too cold to enjoy the drive, but the visitors were able to appreciate the fact that at any time when the thermometer was not playing hide and go seek with zero that Montreal's mountain park must be a lovely spot. Nearly all the ladies of the party attended the drive around the mountain.

Banquet in Montreal.

Perhaps never in its long career has the St. Lawrence Hall had assembled within its walls such a representation of capital as was gathered upon the occasion of the banquet to the Iron and Steel Institute given by the City council, and certainly no banquet has ever been more successful and enjoyable. The speeches were most appropriate. The dining hall had been beautifully decorated with plants and flowers under the direction of Park Ranger McGibbon, and to add to the pleasure of the gathering Lavigne's orchestra played a nice selection of musical items at intervals during the proceedings. The guests were conducted to the dining hall by Piper Major Mathieson, who played a suitable selection on the instrument of Scotia.

Acting-Mayor Hurteau presided in the unavoidable absence of Mayor Grenier, and on his right and left were seated Mr. E. J. Snelus, Sir Donald A. Smith, Mr. H. A. Budden, Mr. E. P. Hannaford, Sir William Dawson, W. H. Bulmer, Col. Holland, C. B., Mr. D. Parizeau, Mr. R. Esdaile and Mr. T. G. Shaughnessy. The vice chairs were occupied by Ald. Clendinning, Prefontaine, Stevenson, Farrell and Villeneuve. In addition to the

aldermen and the members of the Institute, the invited guests also included Sir Casimir Gzowski, K. C. M. G., Prof. Bovey, Hon. Ed. Murphy, Hon. J. R. Thibeaudeau, Hon. Alexander Lacoste, Hon. W. W. Ogilvie, Hon. G. A. Drummond, Dr. G. M. Dawson, Dr. B. J. Harrington, Messrs. J. J. Curran, M.P., A. T. Lapine, M.P., H. McLennan, Richard White, S. W. Wanklyn, D. Preston, K. W. Blackwell, P. W. St. George, E. W. Dodwell, C. A. Massey, Herbert Wallis, J. P. Cleghorn, P. A. Peterson, J. T. Beland, James McShane, J. S. Hall, jr., M. P. P., D. McIntyre, D. Lockerby, Andrew Allen, W. C. Munderloh and Mr. Graham Fraser, manager of the Nova Scotia Steel and Forge Company.

The repast was of a most *recherche* character, and at its close the Acting-Mayor announced letters regretting inability to be present from Hon. G. A. Drummond, Hon. Edward Murphy, Messrs. Andrew Allan, W. C. Van Horne, W. Wainwright and H. Wallis.

The toasts of "The Queen" and "The Governor General" having been proposed from the chair, Ald. Stevenson submitted "The Army, Navy and Auxiliary Forces," which was responded to by Col. Holland.

The toast of "Our Guests" was entrusted to Sir William Dawson, who, in submitting the same, referred to the great and valuable deposits of iron ore in Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba and British Columbia, some of which, he remarked, was of the richest crystalline quality, and capable of producing the best kinds of iron and steel in the world. And we not only had the iron ore, but we had the coal to smelt it with. In the great western plains we had a vast quantity of mineral fuel of a somewhat different kind to that usually found in the mother country. We had great deposits of lignite and we had also bituminous coal. To despise those lignite deposits would be wrong as they would come to be of great economic importance by and by, for there were means by which they could be converted into the best kinds of fuel. If nickel steel should be the sort of steel required for the future, we could also show something in that line, as there were large deposits of the metal at Sudbury and in Newfoundland. In Nova Scotia and British Columbia there were also large deposits of gold which were not yet developed to their full extent. As for silver, there was no question about its being plentiful in the western regions. We had, therefore, in Canada much which might attract the attention of the members of the Institute if they were disposed to look at it from an economic point of view. In conclusion, he expressed an opinion that such a gathering was one in which they should all rejoice, as it tended to make the different portions of the Empire better acquainted with each other, a thing which was needed at the present time.

In responding, Mr. Snelus returned thanks for the hearty welcome which had been extended the Institute, and said they had been delighted to travel through Canada and to notice the evidences of prosperity which were everywhere visible. They had seen trade progressing on every hand, cities being built up substantially, and nowhere had they seen any beggars. Having referred to the great facilities which Canada possessed in its lakes and rivers, he alluded to its fine railways, 12,000 miles in extent, and passed an encomium upon the way in which they had been built. An idea of the vast extent of the country could hardly be gathered by so short a trip as the Institute had made, but when they remembered that they could easily deposit the British isles in one of our lakes without splashing the water over the sides, they could realize the extent of territory we had. He hoped that the members of the Institute would carry home with them such a good account of this country that they would induce a good many more English capitalists to bring money here. In conclusion, he spoke of the beauties of Montreal and its surroundings, and hoped that they would be able to visit it on some future occasion in more sunny weather.

"The Commercial and Mining Interests of the Dominion" was proposed by Mr. J. Stephen Jeans, who said that the members of the Institute had come into this country strangers as to the great resources and capabilities of Canada. They had been informing themselves as best they could with respect to these since they entered our hospitable domains, but it was not easy to speedily know much of a country which was thirty times the size of the British isles, and which had varied resources in every direction. In England they were given to understand that Canada was a land bounded by perpetual ice, a land barren and sterile in the highest degree; a land where it required the circulation of the *Daily Telegraph* to be able to stand the enormously cold temperature. But they came here and found it was a country which did not differ very much, except in the great extent of area, from England. Having spoken of the harmonious manner in which the two great races of the Dominion dwell together, he referred to the import and export trade between Great Britain and the United States and Canada. The British isles imported annually from the United States something like £77,000,000 of produce, and they exported only about half that quantity. From Canada they imported about £6,000,000 of produce and

exported to it about £8,000,000. This was a condition of things most of them would like to see reversed. He would not say how it was to be done, but he believed Canadians were working out their own destiny with enterprise and vigour, and he thought they would find a way whereby the condition of things to which he had alluded would be reversed.

Mr. H. McLennan responded to the toast and said he welcomed the Institute among us to come and see what progress we had made and to judge of what our future might be. Every Canadian to-day felt that an emigrant leaving the mother country and coming here would not suffer disappointment if he had the qualities that had made the men of this country and enabled them to accomplish what they had. We welcomed all to participate in the development of this country. Referring to the products of the Dominion, he expressed a hope that some practical solution would be found by which the mother country would show a preference for what was grown on the soil of the Empire. He would not undertake to say how the thing was to be accomplished, but he thought of adopting some system which would show a preference for the trade which went from British possessions. He had no doubt a solution of the problem would be found, but it behoved every man who had an interest in the prosperity of the Empire to recommend the importance of commercial intercourse as a great bond for cementing and perpetuating that sentiment of loyalty and fraternity which existed at the present day.

Dr. Selwyn, speaking of the mining resources of the country, said he had spent twenty years in studying them, and he felt to-day that he knew very little about them. What the Institute had seen in the Geological museum at Ottawa gave them but a very little idea of what he hoped these resources would be in the future. He regretted that time would not permit of the visitors seeing some other of the mines than those at Sudbury, for instance, the asbestos and phosphate mines, the former of which were very interesting. He hoped, however, that what the members of the Institute had seen would induce them to come here again.

The toast was also acknowledged by Mr. B. T. A. Bell, who said that the extent and importance of the mineral resources of the Dominion were beyond peradventure. They had only to refer to the Reports of the Geological Survey of Canada, and particularly to that excellent volume published in 1863, by Sir William Logan, to ascertain what a magnificent field really existed in the Dominion for the investment of capital judiciously applied. They need go no further than the Province of Quebec, where were found the richest phosphate and asbestos that now supplied the markets of the world—minerals in quantity and quality which were acknowledged universally to have no superior anywhere in the world. The Governments, Provincial and Federal, had spent much money on agriculture, in colonization, on railways, but they had shown most culpable apathy and neglect of the most important of them all—her mineral lands and mines.

Mr. Joseph Richardson submitted in felicitous terms "The Mayor, Aldermen and Citizens of Montreal," which was responded to by the acting Mayor, who spoke of the great improvements which have been effected in recent years.

Sir Donald Smith also acknowledged the toast referring to the fact that it was very little Englishmen knew of the resources of Canada until a few years back, and said we had not only a country of which we might be proud, but a country of which England and the whole Empire might be proud. He assured the visitors that what they had seen of Canada was only the threshold of the country, as, unfortunately, they had not been to the great North-West, which was a very great country indeed, and one to which hundreds of thousands of our fellow subjects on the other side of the water might come and do great good for themselves.

The remaining toasts were "The Ladies," and "The Press," proposed by Ald. Rolland and Mr. J. J. Curran, M.P., respectively, and responded to by Mr. W. D. Phillips and Mr. Richard White.

On the St. Lawrence.

The first feature on the programme for Tuesday was an inspection of the city's celebrated fire brigade on the Champ de Mars. Notwithstanding the bitterly cold morning and the very early hour at which the parade was held, the members turned out in full force, and were greatly pleased with the very fine exhibition given. This over, the party hastened to the Grand Trunk depot where, through the courtesy of Sir Joseph Hickson, a special train had been provided to convey the visitors to Lachine where it was intended to shoot the rapids and return to Montreal by boat.

Everybody was in good humor and enjoyed the short run to Caughnawaga, where all hands went ashore and took possession of the town. It is not to be wondered at that the aborigines viewed with distrust the first coming of the white man to America, if he acted with the lordly air of owning the earth which the visitors assumed in Caughnawaga. They invaded every part of the prim-

ative old town, and awoke the echoes of past centuries by their evanescent modern chatter. The natives received the party with modest courtesy and self-possession, but with no great manifestations of joy. The invaders advanced in procession up the main street of the struggling village, some entering the church and listening to the last sad rights of the church over one that had passed away, while others passed on to witness an entirely different scene.

AN INDIAN WEDDING.

A young brave named Joe Boover had that morning obeyed the scriptural injunction, and with the blessing of the church had taken unto himself a wife from one of the dusky daughters of the tribe. The happy couple happened to pass up the street and were espied and congratulated by the visitors. Joe accepted these congratulations with becoming dignity, while "Mrs. Joe" looked conscious but happy. His slim, lissome figure showed to advantage in the conventional frock coat and dark, wide trousers, the only point in which his dress differed from an ordinary city man being in the white felt hat he wore. His wife looked quite neat and charming in a brown satin dress, with her dusky hair done up in a neat coil at the back of her head and secured by a glass diamond pin. This, and a gold chain around her neck, were the only ornaments she wore. The marriage feast was being celebrated in a house near by, and whether invited or not all hands flocked in until the room was so packed there was no room for the dancers. Like a true gallant Ald. Roll and saluted the bride, and appeared to enjoy this always pleasant duty, and his example was followed by a large number of the gentlemen of the party. After a liberal collection had been taken up by one of the gentlemen, the party returned to the steamer and a move was made down stream.

The run through the rapids was greatly enjoyed, the visitors crowding on deck while the boat tossed and heaved in its passage through the foaming and turbulent waters. It was close upon two o'clock before the party landed at the wharf, each and everyone expressing their deep appreciation of the thoughtfulness of the Board of Harbor Commissioners in providing such a delightful outing on the old St. Lawrence.

Valuable Souvenirs.

A few minutes before six o'clock the members assembled in full force in the ladies' parlor to participate in a ceremony which will linger long and pleasantly in the recollections of the Canadian Reception Committee. In a few words Mr. Snelus gracefully referred to the part these gentlemen had taken in connection with their excursion, and then proceeded to hand each a handsome souvenir of their visit. Dr. Selwyn received a handsome tea service; Messrs. Small and Macfarlane silver plate; Mr. Bell a costly dessert service. Mrs. Snelus also presented Miss Selwyn and Miss Gisborne, the ladies who had accompanied the party, with beautiful gold bracelets. The recipients, who were not a little astonished at these unlooked for tokens of esteem and good will, each fittingly expressed their acknowledgements, and the gathering dispersed.

The party left Montreal the same evening, per special train, for Boston, where it was intended to spend a day visiting the Thomson-Houston Electric Manufacturing Works.

Good-Bye to the Iron and Steel Institute.

BY DR. R. W. RAYMOND, NEW YORK.

What! You're already going away?

Where is that ancient virtue, then,

We used to hear so much of, pray—

The "staying power" of Englishmen?

Your sires and ours were different stuff—

They didn't cleave the ocean foam

For one short month, then cry "Enough!"

And set their yearning sails for home.

Well, Science has made ocean trips

So trivial that you came with ease;

And now, alas! too many ships

Invite you to recross the seas.

Yet we take comfort, since we know,

Whatever else remain unknown,

We cannot lose you now; for though

You sail away, you'll not be gone.

When folks in such a hurry pack,

They make mistakes; and you will find

It is *our* hearts you carry back

And yours that have been left behind.

Yet both shall gain and neither lose,

Meum and Tuum, once apart,

In Friendship's furnace simply fuse

To make one "homogeneous" heart!

Such be our union—ductile, strong,

Well tempered, proof to shot or shell,

Elastic, beautiful, as long

As steel endures! Dear friends, *farewell!*

Proposed Taxation of Quebec Mines.

The Speech from the Throne on the occasion of the recent opening of the Legislature at Quebec, clearly foreshadowed the intention of the Quebec Government to enrich its depleted treasury by some taxation to be levied on provincial mines. The clause fell like a thunder clap upon the mining community in every section of the Province, for it was felt that any incubus at the present time would certainly retard, if not strangle the promising development and progress made in recent years. Speculation was soon ripe as to what form the proposed taxation would take, but enquiries made at Quebec failed to elicit any satisfactory explanation. A prominent Conservative paper ventured to predict a royalty tax on the output of phosphate to the extent of four dollars per ton—a most ridiculous proposition; while a gentleman understood to be well conversant with the movement at headquarters, intimated that no such royalty on any output was ever intended, the probability pointing either to an increase in the price of unsold mining lands, or a system of disposing of these lands on the lease and royalty system adopted and in vogue in Nova Scotia and elsewhere. The question, however, was of too grave a moment to be allowed to pass without a public expression of opinion upon it, and steps were at once taken to call meetings at Sherbrooke and Montreal. The first of these was the

Public Meeting at Sherbrooke,

which took place in the Art Rooms, on Wednesday afternoon, the 12th instant, at two o'clock.

There was a large gathering of mining men and mine managers. The following companies and mining firms were represented:—

Moulton Hill and Howard Mines, F. J. Falding, M. E., manager; G. H. Nichols & Co., Capelton, Messrs. Penhale and Spafford, managers; Eustis Mining Co., Capelton, John Blue, manager; Johnson Asbestos Co., Thetford, R. G. Johnson, M.P.P., manager; King Brothers & Co., Quebec, Mr. James King, manager; United Asbestos Co., Black Lake, Mr. J. J. Penhale, manager; American Asbestos Co., Black Lake, Mr. Wertheim, manager; Lucke & Mitchell, representing the Beaver Asbestos Co.; Memphremagog Mining Co., Brome, Capt. Warne, manager; Central Asbestos Co., Black Lake, W. A. Hale, manager.

In addition to these there were also present Messrs. Wm. Farwell, General Manager, Eastern Townships Bank; J. A. Chicoyne, Mayor of Sherbrooke; J. S. Broderick, J. R. Woodward, F. P. Buck, Major Wood, Robert N. Hall, M.P., W. A. Moorehouse, G. G. Bryant, Sherbrooke; Hon. Henry Aylmer, Richmond; Wm. White, Q.C., H. R. Brown, Q. C., Lieut.-Col. Felton, S. W. Jenckes, general managers Jenckes Machine Co., Col. King, R. D. Morkill, G. H. Bradford, James Addie, H. W. Mulvena, F. C. Thompson, J. H. Walsh, H. D. Lawrence, and many others.

Mr. Robert N. Hall, M.P., was elected chairman of the meeting, and F. C. Thompson honorary secretary.

The CHAIRMAN, in explaining the object of the meeting, said it was held in response to the circulars sent by the mining men of the Province, requesting them to meet at Sherbrooke and discuss the rumoured legislation about to take place at Quebec, as foreshadowed in the Speech from the Throne, as regards the intention of the Government to place a special tax on the product of the mines.

It was thought that such a tax would be injurious to the best interests of the Province, as the mining industries are yet in their infancy. We had a vast amount of mineral wealth in the Province, and this important industry, at all events in its present stage, required fostering rather than any burden placed upon it. The present meeting was, therefore, called for the purpose of taking the necessary steps to represent the matter fairly and impartially to the Government, so that they would have a true appreciation of the importance of the mining industries in the Province.

MR. H. B. BROWN, Q.C., explained at some length the injury the imposition of such a tax would cause upon any efforts to introduce foreign capital into the Province, which, after all, was mainly what we had to rely upon. He gave his own experience with a large American mining company whom he represented. They closely enquired into the question of taxation before investing the large amount of money they have since expended in the eastern townships, and the effect of this tax, if carried out, would most seriously embarrass their operations.

Mr. Wm. White, Q.C., referred to the permanent injury the imposition of this tax would cause to the labouring population employed in mines; in the eastern townships alone, he stated that there were something between three and four thousand men in employment in the various mines in the district, and the proposed legislation would undoubtedly have a most serious effect upon their general welfare—probably resulting in many of them being completely thrown out of employment, owing to the mass of the mines being obliged to close down, and the wages of those who might be retained being consider-

ably reduced. He could not but consider the policy as most detrimental to the mining interests of the Province, and felt confident that if the matter were properly represented to the Quebec Government that they would, no doubt, give it that serious attention which its importance demanded.

Speeches were also made by Capt. Warne, Mr. Penhale, Mr. Wm. Farwell, Mr. Johnson, M.P.P., Mr. James King (Quebec), Mr. Chicoyne, Mr. Wertheim, and others, all strongly condemning the proposed legislation.

The following resolutions were proposed and unanimously adopted:—

First. Resolved: That in the opinion of this meeting the proposed taxation of mining properties, as foreshadowed in the speech of the Lieutenant Governor at the opening of the present session of the Legislature of the Province of Quebec, is a serious menace to the mining industries of this Province, and cannot fail to have a disastrous effect on the development of our mining industries, either by foreign or home capital.

Second. Resolved: That the taxation of our mining industries, now in their infancy, is a suicidal policy, and totally at variance with the true interests of the Province. That most mining industries in this Province are not yet firmly established, and any excessive taxation will cause their discontinuance, thereby throwing some three to four thousand men and their families out of employment, and at the same time will tend to make those still carrying on operations reduce wages.

Third. Resolved: That it is extremely desirable that the exemption from municipal taxation, as contained in Article 1544 of the Revised Statutes of Quebec, should be continued in force for a further period of ten years, and that petitions urging the re-enactment of these exemptions be submitted to the Local Legislature.

Fourth. Resolved: That in order to bring the subject prominently before the public, it is desirable that a representative meeting of all mining men, and of all others interested in the development of the mining industries of the Province, should be held in Montreal at an early date, to take such steps as may be thought necessary to endeavour to influence the Provincial Government to favour the continuance of mining exemptions and to refrain from the imposition of any additional burden in the form of taxation, as intimated in the address of the Lieutenant Governor.

Fifth. Resolved: That an executive committee be formed, with power to call a general meeting of persons engaged or interested in mining in this Province, at an early date, to be held in Montreal, to make all necessary arrangements for such meeting, and to circulate petitions against the proposed legislation, and in favour of the exemption from municipal taxation as contained in Article 1544 of the Revised Statutes of Quebec.

The HON. HENRY AYLMEYER (Richmond) then spoke, condemning any legislation which would in any way tend to embarrass the mining interests of the Province. He expressed great surprise at a measure of this kind being contemplated by a Liberal Government, as, of course, that party was always identified with progress, and he questioned it, when the matter was properly represented to the Government, that they would entertain the idea of imposing an unjust or excessive tax, which would imperil the mining interests of the Province. At the same time he would exert himself, and would use what influence he possessed, against any legislation which he considered in any way detrimental to the interests of mining.

Letters of regret were read from the Hon. J. G. Robertson, M.P.P., Mr. B. T. A. Bell, Editor CANADIAN MINING REVIEW, Ottawa; A. W. Stevenson, Lomer, Rohr & Co., Dickson Anderson, Montreal; the Richmond Quarry and Asbestos Co., Theodore Hamel, Quebec; Prof. J. T. Donald, McGill University, Montreal; R. H. Tylee, Mayor of Ascot, and G. E. Rioux, M. D.

A large committee was at once formed, to complete the necessary arrangements for holding a general meeting of mining men from all sections of this Province at Montreal at early date. The committee is as follows:—

Richard Penhale, G. H. Nichols & Co., Capelton; F. J. Falding; H. B. Brown, Q.C., Moulton Hill and Howard Mines; Capt. Warne, Memphremagog Mining Co.; Hon. H. Aylmer; Jas. King, King Brothers, Quebec; Wm. White, Q.C., John Blue, Eustis Mining Co.; A. S. Johnson, Johnson's Asbestos Co.; A. S. Hurd, for Bell's Asbestos Co.; W. A. Hale, Mayor of Orford; J. S. Mitchell, Beaver Asbestos Co.; F. C. Thompson; L. Wertheim, for American Asbestos Co.

At a subsequent meeting it was decided that the general meeting of all mining men of the Province be called at the St. Lawrence Hall, Montreal, on Friday, the 21st inst., at 2 p. m.

There appears to be the utmost unanimity of feeling with regard to the proposed tax. The matter is looked upon entirely in a business light, the question of politics being absolutely excluded, and the representatives of both parties taking a prominent part in the movement.

Meeting of Ottawa County Mine Owners and Operators at Montreal.

Meanwhile the phosphate miners, and others interested in mining operations in the western portion of the Province, were not idle. In the Lievres district, at Ottawa, and elsewhere, the proposed taxation excited much speculation and a good deal of severe criticism. A hurried and informal meeting was held at Buckingham, from which a circular letter was issued calling a general meeting in Montreal.

This meeting was called for half-past eleven o'clock in the forenoon, and notwithstanding that it was the closing of the shipping season, and consequently a very busy time at the mines, the attendance was fairly good.

There were present: S. P. Franchot, Managing Director Ottawa Mining Company, Buckingham; F. Hilton Green, of Messrs. Wilson & Green, Montreal, representing the Phosphate of Lime Company; Capt. Robt. C. Adams, Managing Director Anglo-Canadian Phosphate Company, Montreal; Ed. Wertheim, Managing Director American Asbestos Company, Black Lake, Que.; F. J. Falding, M. E. Moulton Hill and Howard Copper Mines, Capelton, Que.; E. V. Wright, Lake Temiscaminge Silver-Galena Mines, Ottawa; Angus Cameron and Wm. Macintosh, mine owners, Buckingham, Que.; G. Capel, A. M. Perkins, A. W. Stevenson, Montreal; James Cooper, President of the Ingersoll Rock Drill Company of Canada, Montreal; Mr. B. T. A. Bell, Editor CANADIAN MINING REVIEW, Ottawa, and about half a dozen others.

Capt. R. C. Adams was called to the chair, and Mr. Bell asked to act as secretary.

After a general discussion, it was unanimously agreed to support any resolutions to be passed at the meeting in the afternoon, which would urge upon the Government the desirability of continuing the exemptions from municipal taxation as contained in Article 1544 of the Revised Statutes of the Province. The meeting expressed a very decided opinion that any royalty tax upon phosphate, however small, would seriously cripple active mining work, and would be entirely prohibitory to the investment of foreign capital in the lands and mines of the Province. A suggestion was made by Mr. Bell, that the time was now ripe to form a General Mining Association for the Province of Quebec. He pointed out that if such an association, representing the whole mining and quarrying interest of the Province, was formed, and operated judiciously and energetically, much good would unquestionably ensue to these industries. Such an association would always be prepared to cope with any emergencies that might arise in the future. The proposal was most favorably received. The meeting then proceeded to draft a Constitution for such an association. It was resolved to bring the matter before the meeting in the afternoon. The company then adjourned to unite with the other mine-owners and operators in the

Large Gathering in the St. Lawrence Hall.

Prompt at two o'clock the large company which had assembled in the rotunda of the Hall moved downstairs to the commodious meeting place provided by Mr. Hogan. Among those present were noticed: J. N. Greenshields, Q.C., Excelsior Copper Co., Montreal; W. H. Nichols, Capelton Chemical and Fertilizer Works, Capelton; W. E. C. Eustis, President, Eustis Mining Company, Capelton; Hon. George Drummond, President, New Rockland Slate Co., Montreal; A. Desjardins, M.P., Brompton Lake Asbestos Co., Montreal; S. P. Franchot, Managing Director, Ottawa Mining Co., Buckingham, Que.; R. N. Hall, M.P., Sherbrooke, representing Dominion Phosphate Co.; E. Wertheim, Managing Director, American Asbestos Company, Black Lake; W. Irwin, Anglo-Canadian Asbestos Company, Black Lake; O. M. Harris, Canadian Phosphate Co., Montreal; James King, Messrs. King Bros., Quebec; Thos. Trimble, Templeton and Blanche River Phosphate Co., Montreal; James Cooper, Ingersoll Rock Drill Co. of Canada, Montreal; E. V. Wright, Ottawa; A. Cameron, W. Macintosh, Buckingham; Hon. Wilfrid Laurier, Laurier Mining Co., Black Lake, Que.; F. J. Falding, M.E., and H. Brown, Q.C., Sherbrooke; A. W. Stevenson, G. Capel, F. D. Taylor, M.E., Montreal; Lucius Boyd, M.E., Sherbrooke; Mr. Penhale, Scottish Canadian Asbestos Co., Black Lake; W. A. Hale, Sherbrooke; John Blue, Supt. Eustis Mines, Capelton; Jas. S. Mitchell, Sherbrooke; Dr. James Reed, Reedsdale, Que.; A. Lomer, Messrs. Lomer, Rohr & Co., Montreal; and about fifty others.

On the motion of Mr. R. N. Hall, M.P., Mr. J. N. Greenshields, Q.C., was called to the chair, Mr. A. W. Stevenson, acting as secretary to the meeting.

MR. GREENSHIELDS briefly explained the objects of the meeting, which, he pointed out, was called to discuss a suggested taxation on the mining industry, contained in the Speech from the Throne at the recent opening of the Quebec Legislature. This was not the first time that such a tax had been mooted. In 1868 the Minister of Agriculture had proposed a similar tax. But it having been pointed out to the Premier at that time that the proposition was a most un-

reasonable one, and would, if carried into effect, militate seriously against the mining interests of the country, it was allowed to drop. He trusted that as a result of their deliberations representations of such gravity and weight would be made to the government as would induce them to forego the intention with which they had been credited—namely, to impose a tax upon the mines.

HON. GEO. DRUMMOND, President, New Rockland Slate Co., claimed that the question had no connection with politics, and politics should not in any way be called into their deliberations. The Government, like all other governments, wanted money, and they had picked upon the miners to supply their demand. It would be agreed upon all hands that the placing of a tax upon mineral products would act prejudicially upon the interests of the Province. Everyone knew that the Provincial Government was hard up for money; but to endeavor to obtain funds by taxing the mines would be simply to kill the goose in order to get the golden eggs (Cheers and laughter.) He warned the Government against the consequences of incurring the displeasure of so large and influential a body of men as the mine-owners of the Province. The imposition of this tax would not only affect one or two classes of people, but would recoil upon several classes, particularly the workingmen; and he urged that this point should be pressed upon the attention of the Government.

MR. R. N. HALL, M.P., for Sherbrooke, referred to the meeting of mine owners recently held in his town, at which he himself had been chairman. The unanimous feeling of that meeting was that it would be a great misfortune to place any burden upon the mining industries of the Province. (Applause.) It would prevent the introduction of foreign capital, and it would also injure the laboring classes, as Senator Drummond had pointed out. There could be no doubt that the future prosperity of the Province depends largely, if not wholly, upon the development of the mineral resources with which nature has so bountifully endowed the Province. We are so situated that we require foreign capital to aid us. He was afraid that damage had already been done by the very suggestion of this tax. He concurred in the view that the representations to be made to the Government should be free from political bias.

HON. WILFRED LAURIER having been called upon by the Chairman, said he had just dropped into listen, and had no intention of making a speech. He was personally interested in mining operations in the Province, and although he would not go so far as to say that after mines had reached a certain stage of development they should not be made to yield some public revenue, still he felt that to impose any new burden upon what was yet a new industry would not only be detrimental but fatal. (Cheers.) He deprecated the introduction of politics into the matter. He need not tell them that he was a supporter of Mr. Mercier (laughter and applause), but he was nevertheless ready to join those present in demanding that an industry in which he was to some extent interested should be safeguarded. He fully believed that when the bearings of the subject were placed fairly and justly before the Government they would shrink from the adoption of legislation injurious to the interests of the Province.

MR. B. T. A. BELL, Ottawa, agreed with the Hon. Mr. Laurier that it would be well to make haste slowly. The Government had not intimated any outline of its policy other than the vague and uncertain suggestions conveyed in the Speech from the Throne, and until it was known what form Mr. Mercier's proposition was to take, he thought great care and prudence should be exercised in any criticism. He thought the time had come for the organization of a representative mining association, which could be organized on a basis to cope with this or any other emergencies that might arise in the future. He hoped to submit a resolution to this end at a later stage, when the discussion on the proposed taxation had been ventilated.

MR. W. H. NICHOLS, of New York, operating the Albert Mines, and the Capelton Chemical and Fertilizer Works, said that as a stranger in a strange land it would be presumption for him to suggest to the Provincial or Dominion Government how they should raise their revenue. He could not, however, conceive it possible for a civilized Government in the northern portion of this continent to impose a tax upon the products of mines. He could understand such a proposition emanating from the Government of Bolivia or Ecuador. The firm with which he had the honor to be connected was engaged in copper mining in the Eastern Townships, and in the phosphate business in the Ottawa Valley. They were trying to bring both industries together, so as to be able to provide the farmers with a cheap fertilizer (cheers). Mr. Eustis and himself were operating on each side of Capelton Mountain, and he considered they conferred some benefit upon the people there. He hoped also that an effort would be made to secure a continuance of the exemption of mines from Municipal Taxation. Mine

owners wanted no bonus, but he thought they should receive some encouragement in other respects. Who opened up a new country? The farmers? The lumbermen? No; it was the miners (hear, hear and cheers). He had recently started to open up the old Huntingdon mine, but if he had heard about this tax he would have hesitated before doing so.

MR. W. E. C. EUSTIS, President Eustis Mining Company, Capelton, said that the mines at Capelton produced a copper ore of low grade, entailing every economy, and any increased taxation, either Municipal or Government, would unquestionably be prohibitory to further operations by his company.

MR. S. P. FRANCHOT, Buckingham, declared that the imposition of a tax upon the mines would simply mean ruin. The phosphate industry on the Lievres River alone employed thousands of laborers, and the result of the tax would be that these men would have to seek employment elsewhere. The development of the industrial resources of the Province was still in its infancy, and it would remain in that condition if legislation were passed which would have the effect of keeping foreign investors out of the country.

CAPT. ADAMS, Managing Director of the Anglo-Canadian Phosphate Co., Montreal, asserted that mine-owners had no disposition to evade contributing a just share to the revenue of the country. He was in favor of the principle of leasing mines on royalty, which obtained in Nova Scotia and other parts of Canada. Mine owners deserved great consideration from the Government, for theirs was the only industry which had stood manly and independent, and had never asked for any Government support. People engaged in other industries were rolling in wealth through cunningly devised legislation obtained in their favor from the Government. All they wanted was a fair field and no favor.

MR. R. W. HENNEKER, Sherbrooke, advised that great care be taken in approaching Mr. Mercier's Government. The Premier was a far-seeing, clear-headed man, who would listen patiently to any representations made to him in the interests of the country. If it were shown to Mr. Mercier that his ideas on expatriation would be seconded by the mine owners, who give employment to French-Canadians and thus keep them at home, he would pause before he imposed this tax. Mining was the forerunner in the opening up of a new country. This was apparent in that long stretch of country lying between Quebec and Sherbrooke, once a "howling wilderness," but now, under the pioneering influence of the miner, becoming a settled country.

MR. ED. WERTHEIM, American Asbestos Company, contended that if all the mines were worked at a profit, there might be no objection to the imposition of a reasonable tax, but the industry was young yet and many of the mines were only beginning to get their heads above water. Any taxation just now would be prejudicial to the best interests of the industry of the Province.

CAPT. R. C. ADAMS proposed the following resolution:—

Resolved, That it is extremely desirable that the exemption from municipal taxation, as contained in article 1544 of the Revised Statutes of Quebec, should be continued in force for a further period of ten years, and that petitions urging the re-enactment of these exemptions be submitted to the Local Legislature. Carried unanimously.

The following committee was appointed to watch any legislation affecting the welfare of the industry, and if necessary to wait upon the Hon. H. Mercier:—J. N. Greenshields, Q.C., Montreal; R. N. Hall, M.P., Sherbrooke, Que.; Hon. Geo. Irvine, Quebec, Que.; Capt. R. C. Adams, Montreal, Que.; Robert Blackburn, Ottawa, Ont.; S. P. Franchot, Buckingham, Que.; Wm. King, Quebec, Que.; W. E. C. Eustis, Capelton, Que.; W. H. Nichols, Capelton, Que.; Hon. George Drummond, Montreal, Que.; B. T. A. Bell, Ottawa, Ont.

MR. BELL then submitted his resolution, urging the organization of a General Mining Association. He contended that if this were done questions such as those dealt with at this meeting could be handled much more efficiently than at present. Apart from all questions of legislation, such an Association would greatly benefit the members by an interchange of knowledge and ideas, and much good to the Province could be accomplished by the dissemination of authentic information respecting the extent and value of its resources.

MR. W. H. NICHOLS, while agreeing with Mr. Bell that an Association would be a good thing, thought the matter deserved more consideration than could be given in the limited time at this meeting. He thought the matter should be held over until another meeting.

After some further discussion it was decided to leave the matter in the hands of the Committee, and the meeting adjourned after a vote of thanks to the Chairman and Secretary.

Proposition to Erect Nickel-Refining and Steel Works in Ontario,

The following is the full text of a letter from Mr. S. J. Ritchie, of Akron, Ohio, President of the Central Ontario Railway, and one of the leading promoters of the Canadian Copper Company, Sudbury, to Sir John Macdonald, praying for a Government bonus for the completion of the Central Ontario Railway, from Coe Hill to the Sudbury mines :—

OTTAWA, November 10, 1890.

To the Right Honorable Sir John A. Macdonald, G.C.B.,
Minister of Railways, Ottawa :

On numerous occasions during the last six years I have asked the Government to aid the Central Ontario railway in extending its line from Coe Hill to Sudbury. During the greater portion of the period there were many questions in connection with the metal interests of the country to be traversed and to be reached by the completion of this line which were only partially solved, and the success of the line when built thus rendered somewhat problematical; and to this cause I have attributed the failure of the Government thus far to comply with my request. Happily now, all these obstacles have been overcome and mastered, and the development and manufacture of these minerals in Canada has become a question second in importance to no other commercial question in the Dominion.

By cheap and simple processes even very low grades of magnetic iron ores can be converted into the highest and purest grade of ores which are offered in any of the markets of the country, and they are thus well adapted to the manufacture of the very best quality of steel. In addition to this you doubtless are well aware of the great revolution in metallurgy recently made known to the public by the alloying of nickel with steel, the product being known as nickel steel.

Nothing in the manipulation of metals since the discovery of Sir Henry Bessemer has created such widespread interest among the steel manufacturers of the world as the results obtained from the nickel steel. Wherever it will be possible to obtain this material the war vessels of the world, together with their armament, will doubtless be made from it. This statement I have from the highest officials having these matters in charge.

Its extensive use for commercial purposes where a metal of superior excellence is required is equally well assured. Canada possesses probably five-sixths of the world's supply of nickel. Such being the case she can control the markets of the world and the uses to which this metal shall be applied. She also has inexhaustible supplies of iron ore, which, until the invention above referred to, were neither available for manufacture at home nor saleable abroad.

The comparative close proximity of these iron ores to these nickel deposits, both of which are inexhaustible and almost incomputable supply, would seem to render any argument unnecessary as to the proper use to which they should be put. That they should be manufactured in Canada, and the manufactured material shipped to the markets of the world, instead of only the crude materials being produced in the country and shipped to foreign markets, would seem to be a question susceptible of only one answer.

After having mastered a solution of all these metallurgical questions and processes, after their importance has been acknowledged and passed upon by the highest authorities in the world, including, among hundreds of others, the owners and managers of the great steel works of Schneider & Company, of Le Creusot, France; the great works of the Steel Company of Scotland; of the world-wide known works of William Jessop & Sons, of Sheffield; of the results obtained by experiments and tests made in the interests of the French, German, Austrian, British and American Governments, I again come to you and ask your aid, not only for the completing of this line of railway, but also for the building up of a great steel plant which shall produce an article which can be shipped to and find a purchaser in every market in Europe. It may be said that the natural advantages here should be sufficient inducement for other investors or manufacturers without any Government aid, but you must remember that Canada is without any industry of that kind, and that her facilities and resources are not well understood by people of other countries where these industries are developed on a great scale, and no matter what her advantages are or may be it would be impossible to induce capital sufficiently large to engage in an enterprise of this kind without some Government backing. If the same opportunities, even in a small degree, existed in the United States, Great Britain, Germany or France, capital in any amount required could at once be had to utilize and develop them. But the conditions here at present are different, and if

Canada is to take her place among those countries which are producers of manufactured articles instead of a producer of raw materials, the Government must take the initiative and help those who are willing to engage in and push through this enterprise.

I therefore ask of your Government, on behalf of the Central Ontario Railway, a bonus of six thousand dollars per mile from Coe Hill to Sudbury, a distance of about two hundred and six miles; and that you grant a bonus of thirty-two hundred dollars per mile on the portion of the line already completed between Trenton and Coe Hill, a distance of about seventy-two miles; this last sum to be used in the building of blast furnaces upon the line of railway.

2. For the purpose of erecting and carrying on a large steel plant upon the line of railway for the manufacture of nickel steel from the iron ores along the line of road, and from the nickel ores of the Sudbury district, I also ask your Government to guarantee the interest at the rate of three per cent. per annum on a capital stock of five millions of dollars for a period of ten years, and in order that we may at once perfect our negotiations for carrying out this enterprise I would most respectfully ask that your Government pass an Order-in-Council granting this aid, under such safeguards as shall insure to the Government their successful completion and carrying out.

If the Government shall be pleased to make these concessions to the interests I here represent, a great industry will at once be built up in Canada, and she will sell to the markets of the world a manufactured article instead of raw materials. She will find a market for her labor at home, with a growth of all the varied interests which spring up around such large manufactures. To illustrate the possibilities of a great steel plant I may say that the business of Carnegie & Co's firm at Pittsburg during the present year is much larger than the combined business, during the same time, of every mile of railway and steamship owned or operated by both the Grand Trunk and Canadian Pacific Railways both in Canada and the United States. Yet the sources from which this great firm derives its supplies of raw materials are in the aggregate but a small percentage of extent to those to be opened up, connected and made available by the extension of this line of railway. The several interests in this railway and in the iron, nickel and copper mines which it will bring together will all be pleased to heartily co-operate with your government in building up a great industry in your country, if by your aid you will make it possible for them to do so. This whole subject in all its bearings and connections is quite well understood by your Government, but in order to place the matter in at least approximately definite form before you, I submit the following figures as illustrative of the importance of the enterprise for which I ask your aid :—

1. Line of Central Ontario—110 miles already completed with equipments...	\$2,500,000
2. Line to be built, say 210 miles with equipment	6,000,000
3. Capital for steel plant	5,000,000
4. Capital for working the copper and nickel mines with a capacity of ten furnaces, and about thirty miles of railway to connect all the various deposits with the central smelting plant, together with all the necessary machinery, houses and plant of every kind adapted to a capacity of ten furnaces, as well as to provide for the working of the iron mines, at least....	5,000,000

\$18,500,000

To recapitulate, then, I ask of your Government first a direct bonus to the railway of say (about 320 miles when completed)

\$1,500,000

This would involve to the Government an annual interest charge of about

\$50,000

The guarantee of five millions of stock for steel plant at three per cent. per annum for ten years—this would involve an annual interest charge upon the Government of

150,000

Or a total interest charge for ten years of

\$200,000

And of \$50,000 per year thereafter.

From such knowledge as you have of the importance of like industries in other countries, I submit whether your Government has ever incurred an obligation of like magnitude which promises so much in return for the development of your country, and I most earnestly urge your speedy and favorable action that we may be enabled to close our negotiations and to proceed at once in building up and carrying out this whole enterprise.

Very truly yours,

S. J. RITCHIE,

President Central Ontario Railway.

The Canadian Phosphate Industry.

The Chemical Manure Manufacturers' Association held a meeting in London last month, Mr. Hermann Voss, the president, occupied the chair. There was a good attendance. Mr. W. H. Hutchinson read the following paper on "The Canadian Phosphate Industry" :—

"A few weeks ago, when the president of the Chemical Manure Manufacturers' Association, knowing that I had been in Canada in the autumn of 1889, with the object of examining the phosphate industry, paid me the compliment of asking me to read a paper on the subject before your Association, I consented after a little hesitation to do so, in the hope that my paper, short and incomplete as it might be, would prove of interest to some and serve to evoke discussion, in which those who have greater experience and knowledge would give us the benefit of their views.

Not more than twenty years ago, the Canadian phosphate districts, which are now alive with the many signs of active mining operations, remained in a condition of almost perfect tranquillity. Here and there were a few small scattered farms, but the district being, for the most part, little suited for agriculture on account of the sterility of the thin soil overlaying the rocks, its solitude was disturbed only from time to time by the ring of the lumberman's axe and the occasional visit of some enterprising member of the Geological Survey. The latter had previously led to the discovery of apatite, and after further investigation and study had shown that there was every ground to calculate on the ore being present in quantities; mining operations were begun on a tentative scale, with results affording such good prospects of success, that gradually the district became transformed into its present state of activity. Now, during the busy season, the rattle of tramcars and carts hauling phosphate, the puffing of the small steamers passing up and down the Du Lievre river, and the frequent reports of explosives create a sense of bustle which would vex the soul and call forth expressions of strong disapproval from any disciples of Mr. Ruskin, if, perchance, any of them find their way to the neighborhood.

The phosphate-bearing districts cover a wide extent of ground, lying chiefly in the provinces of Quebec and Ontario, the more important being in the former, situated north of the Ottawa river and comprised principally in a broad belt of from twenty to twenty-five miles wide, passing through the townships of Templeton, Buckingham, East and West Portland, Bowman, and still further north. A lumberman told me that he had seen outcrops of the ore 150 miles further up country, but the more outlying districts are very wild and have still to be properly explored.

Phosphate is also found in other districts, for instance, in Wakefield, Hull, and Denholm townships, Ottawa County, but at present, not in such important quantities.

In the Ontario district the phosphate lies in the townships of Loughboro', Hinchinbrook, Olden, and Bedford, County Frontenac, and in the township of North Burgess, County Lanark, where, I believe, it was first mined.

Geologists point out that the phosphate districts particularly in the Quebec province are included in the belts or zones of pyroxenic rocks, which occur in the Laurentian rock formation—the oldest known formation. Pyroxenic rocks may therefore be termed the mother rock of the apatite, which occurs in it in veins, sometimes enlarging into pockets of great magnitude, sometimes "pinching in" to almost invisible strings, and sometimes dislocated by rocks thrown across by later formations. On the map—which is enlarged from one made by Mr. J. Lanson-Wills, of Buckingham, the mining expert—the supposed extent of the pyroxenic belt is shown. In the Province of Ontario apatite is also found in gneiss or similar rocks, which, however, often include crystals of pyroxene.

Apatite exists in almost all stratified and crystalline rocks in minute quantities, but has been found in commercial quantities only in Canada, Norway and in Spain; but in neither of the latter countries, owing to the difficulties of mining and transport, has the industry assumed large proportions.

How the apatite got into the rocks is a question which has exercised the minds of geologists, who, however, have not yet been able to arrive at a unanimous conclusion. Various theories have been put forward. Professor Dawson, in an interesting note on the origin of phosphate deposits, in a paper read by him before the Ottawa Field Naturalists' Club, in 1884, expresses the opinion that the apatite occurs as sediment, deposited in the earliest seas of which we have any trace, and which originally resembled those of later seas, but have become so completely altered that their materials have entered into new combinations, and have, by igneous action become entirely crystalline, resembling now the original deposit as little as do the crude ingredients of glass the finished product. In opposition to this, which may be termed the "sedimentary rock" theory, Dr. T. Sterry Hunt

also a great authority, at the conclusion of some technical remarks on the subject, says:—

"I am disposed to look upon the apatite as true beds, deposited at the same time in the enclosing rocks."

While Mr. Wurzbarger, an eminent mining expert who was with me in Canada, has formed the opinion that:—

"As chemical analyses show in the pyroxenite rock itself a small percentage of phosphate of lime, it may be considered as probable that the apatite in the veins and pockets have been extracted from the pyroxenite by hydro-chemical action."

There is yet another view, that the apatite is the result of purely volcanic action, having been thrown up from the bowels of the earth.

Where doctors disagree who shall decide? But although doubt may exist as to the origin of the ore, there is no uncertainty as to its quality and characteristics. Apatite is the purest form in which phosphate of lime is found to exist in quantities—containing when of the first quality from 80 to 87 per cent. of tribasic phosphate of lime and only 1 to 2 per cent. oxide of iron and alumina.

In a perfectly pure form it is composed of—

Phosphoric acid 42.26=tribasic phosphate of lime 92.26

Lime (oxide of	
calcium) ..	50.01
Calcium ..	3.96
Flourine ..	3.76
	99.99

The average analysis of "first" quality shipped may be recorded as—

Phosphoric acid 37.88=tribasic phosphate of lime 82.72.

Carbonic acid ..	1.80
Lime ..	54.65
Iron oxide and	
alumina ..	2.72
Silicious matter	0.62
Moisture ..	0.21
Flourine, sul-	
phur, etc. ..	2.12
	100.00

Any gentleman who would be interested in more detailed analysis will find a table of eight full analyses appended on the placards.

Shipping samples of a parcel now *en route* from the Aetna Mine show 85.05 phosphate of lime with respectively 0.95 and 0.90 oxide of iron, but this must be considered an exceptionally good quality.

The ore is generally, as shown by the samples in the table, of a heavy, close-grained character, but sometimes it is forthcoming of a looser nature, when it is technically known as "sugar phosphate." In some mines it exhibits a more distinctly crystalline character, some of the crystals being of very striking dimensions. There is one almost perfect in form in the Ottawa Museum. It measures 32 in. in length; the diameters being 22 in. and 17 in., and weighs, probably, about 7 cwt. On the Aetna Mine a crystal more than twice the size, estimated by Mr. Würburger to weigh six tons, and measuring 7 ft. high, with a diameter of 4 ft., was found. Unfortunately, owing partly to its great weight and to its surface being cracked from exposure to the frosts, it was found impossible to preserve it intact. A sample taken from it yielded 88.43 per cent. tribasic phosphate of lime.

The colour of apatite is usually dark green, but some mines, notably in the Ontario district yield large quantities of excellent phosphate of a red and reddish-brown colour. It is also found almost black, and again of pink and violet tints. The shades of colour appear to depend on the chemical composition of the mineral, the usual green tint being probably due to flouride of calcium, but the colouring matter is so minute that, when phosphate of different shades is ground, it is hardly possible to distinguish one from the other, all being of the whitish tint. The shade of colour is no indication of quality, which can be only ascertained by analysis.

It requires an eye, taught by considerable experience, to distinguish with certainty apatite from the surrounding rocks. In this respect it is very true to its name, which is derived from a Greek word meaning "deception." I heard of one farmer who, having discovered, as he fondly thought, a deposit of apatite on his property, worked at its extraction with all his energy until he had raised some hundreds of tons, when, wishing to turn it into cash, he discovered, poor fellow, to his intense chagrin, that he had wasted his time in raising a pile of the country rock, somewhat resembling apatite in appearance.

As might be expected from the high character of apatite, it is found to be a most excellent material for conversion into superphosphate. When treated with acid it yields a higher percentage of phosphoric acid, soluble in water, than any other raw phosphate material with, perhaps, the exception of Curacao phosphate. The first quality dissolved in acid of 140 deg. gives a superphosphate with 18 to 20 per cent. of phosphoric acid equal to 40 to 45 per cent. soluble phosphate of lime.

The condition, although dampish at first, becomes in a month's time dry, friable and everything that could be desired.

Although the existence of apatite in the phosphate districts had been long known to some geologists, it was not until about 1872 that mining operations were begun in Ontario, and about a year later in the Ottawa district. I have not been able to ascertain to whom belongs the honour of opening up the industry. In Ottawa city there seem to be several elderly gentlemen who claim the credit. Soon after I arrived there, an old gentleman introduced himself and explained that he was the first man to bring to Ottawa samples from a quantity extracted on his property. I was naturally much interested, and noted the circumstance. A few days later, another old gentleman informed me he was the first, and yet another old farmer impressed on me that he was really *primus inter primos*. There are probably more men who lay claim to the honour than there were Greek cities which claimed to be the birth place of Homer. In the first years of the industry, especially in the Ontario district, the raising of the apatite was conducted in a very primitive fashion. It was the custom to contract with local farmers to pay them a fixed sum per ton of apatite raised in a lot of land without stipulating how the work should be done. As a consequence, the farmers raised only the ore easily got at near the surface, and when it became necessary to expend more labour on its extraction, the working would be abandoned for a fresh surface outcrop; neither was sufficient care taken to keep the ore clean, the object being to raise the maximum quantity of ore with the minimum labour, apart from all other considerations. The contract system is still in vogue to a certain extent in the Ontario district, and is found, under careful supervision, to work well.

In the Ottawa district, however, where the phosphate occurs in larger masses, the contract system has never taken hold, the mines having been worked by the proprietors, at first, chiefly as open pits or quarries, but in the last few years, in the most important mines, where the phosphate has been followed some hundreds of feet down, by regular shafts and underground workings and galleries. The *Canadian Mining Review*, so late as 1885, wrote: "The system at present in vogue at almost all mines is much akin to open quarrying, and it is argued by scientific miners that this cannot be the most economical way of raising the ore, as it entails the removal of an unnecessary amount of rock. The nature of our phosphate deposits is, however, so different to that of other mineral veins, and their character so irregular, that it requires close and careful observation of the immediate vicinity to determine how the deposits can be worked with most advantage. At the present time powerful machinery and regular mining apparatus is brought to bear in the most important mines in the extraction of the mineral. It is still found, however, as year after year adds fresh experience and greater knowledge, that apatite mining is certain only in uncertainty. The deposits are so extremely irregular in extent and breadth, so liable to "pinch in" to a mere streak, to disappear altogether for some space, to be interrupted by a dyke of trap rock, or fault, as it is technically called, that it is hazardous to calculate on a regular large output from any one pit. One week the manager reports prospects of the rosiest character, the following mail brings news that the vein which promised so well is looking black, and instead of opening out into the hoped for pocket of some thousands of tons, has pinched in to almost nothing, perhaps disappeared, and before it can be again recovered a large amount of dead work must be done, involving some weeks of heavy, unremunerative outlay. As Captain Adams graphically described the phosphate occurrence in the words of an old miner: "It is long, and it is short; it is wide, and it is narrow; it is deep, and it is shallow; it is thick, and it is thin; it is here, and it is there; you have got it, and you haven't; you see it, and you don't see it." To counteract the effects of this uncertainty, the careful manager must therefore have several pits working at the same time, so as to keep up a good average permanent output."

In order to present to you a clearer idea of the Ottawa mining district and the mining process, I would ask you to mentally accompany me on a visit to one of the principal mines. Leaving Ottawa by an early train we arrive, after a railway journey of about an hour and a-half, at Buckingham station on the main line of the Canadian Pacific Railway, where an engine and a few carriages are waiting to convey us by a branch line about four miles long (constructed about five years ago and opened early in June, 1885, by Lord Lansdowne, on his way to pay a visit to High Rock Mine), to Buckingham Village wharf, where we jump into the little mail steamer, *Agnes*, probably 23 horse-power, which, after having taken in some packages for the mines, starts up the du Lièvre River. On board there are a few other passengers for the mines, and a party of lumbermen going to a timber limit up-country. Rather a rough set are they, chiefly French-Canadians, who beguile the time by singing choruses in patois. They will remain in the woods until the following spring, sleeping in a wooden shanty to be first erected by them, and living principally on salt pork, beans and

tea. In the spring time they return, fatter and stronger in health than they go up, in spite of the severe climate, hard work and not tempting food. This proves the healthfulness of the dry cold of the Canadian winter.

After leaving Buckingham wharf the steamer proceeds up the river for about thirty miles. When I was there in the autumn, the water in the river was so shallow that when we came to the Little Rapids, about twelve miles up the river, we had to disembark, make a *detour* on foot, and embark on the other side of the rapids in another steamer. On the way up the gorgeous and brilliant colours of the foliage on each bank of the river, and the beauty of the views on either side, have filled us with admiration. At the wharf we are met by the manager of the mine, who gives us a warm welcome, and we go by a tramway drawn by a horse up an incline to the manager's house, about two miles distant, where we are vociferously greeted by a chorus of dogs. After having, through the hospitality of the manager, satisfied our hunger, sharpened by the exhilarating air, we are introduced to the pets of the place, consisting, beside the dogs, of three large bears, raised from babyhood by hand, very sleek and tame, a fox and a squirrel. We are then shown over the building, strongly built of timber, and comprising a cook house, savoury at the time with the odour of cooking joints, the sleep house, &c., and afterwards proceed to the workings. We descend the pit either by a ladder, which is rather difficult climbing to a Londoner, or by the bucket attached to a derrick, and, arrived at the bottom, find miners at work loading the phosphate into the tub to be hauled by the derrick to the pit mouth. The manager guides us by the light of a candle along a side gallery, where the miners are at work with the rock drills, preparatory to the use of explosives, and we are shown the thick vein of ore, from which it is hoped to win some thousands of tons. It is, in fact, a rich pocket of fine quality. The shaft is down about 150 feet, and is one of several being worked on the mine. There is very little water drainage to the pit, the surrounding rock being of too hard a nature to admit of much percolation. After examining the mining process and admiring the fine quality of the extracted ore, we are hauled to the top again, where we see how the mineral is loaded into the cars running along a narrow tramway. Jumping into one of these, we are conveyed to the cobbing house, where the important process of separating adhering bits of foreign rock from the apatite takes place. We remark how the apatite is first passed through an inclined circular sieve, worked by machinery, the finest part of the ore passing through the $\frac{3}{8}$ in. mesh of the upper half of the sieve, while the more granular particles pass through the coarser mesh of the lower half of the sieve. The finest portion is first and second quality, and the coarser thirds. This simple classification is practicable, because the apatite, being more friable and easily broken than the harder associated bits of rock, the finest portion is freer from impurities than the more granular. The lumps and larger bits rejected by the sieves pass into the hands of boys who cob it—that is, with small hammers knock off the impurities and separate the practically pure ore from pieces of associated rock. By the process of sifting and hand-cobbing, three qualities are prepared—1st quality, 80 to 85; 2nd, 70 to 75; 3rd, 60 to 70 per cent.

We are then shown how the ore is loaded again into tramcars, which convey it rapidly down the incline to the wharf, where scows are waiting into which it is loaded direct from the wharf. There we leave the mine, having spent a pleasant and instructive day. From the wharf the ore is conveyed by scows—flat-bottomed barges—to the wharf at Buckingham, where the ore is loaded into the railway cars and forwarded either to Montreal for shipment to Europe, or—and especially the lower grades—to the mills at Buckingham, to be ground for the American market. In the autumn, when the water in the river is low, one steamer brings the scows to the Little Rapids, and another steamer to the wharf at Buckingham. Sometimes the water is so low as to seriously inconvenience the passage of the scows.

The cost of mining, cobbing and transporting to the wharf, varies according to the character of the deposit and purity of the ore, depth of working and local circumstances, from 5 dols. to 10 dols., say average 8 dols.=£1 12s., and the cost of shipment to Europe from the mine wharf, say £1, thus first cost delivered in Europe, £2 12s. per ton, but of course this does not include anything for interest on capital, management, machinery, roadmaking, and wharf-building, other development work, amortization, neither does it take into calculation the possibility or rather probability of the mine sometimes looking black, and the necessity of doing a great deal of dead work, upon which items the success of the mine really depends.

The value of apatite at the present time in the United Kingdom may be noted at for the respective qualities of—

84 per cent., 1s. 4d. per unit, with 1-5th d. rise, equal to.....	£5 17s. 6d.
80 per cent., 1s. 3½d. per unit, with rise, equal to.....	5 3s. 4d.

70 per cent., 1s. $\frac{1}{2}$ d. per unit, without rise, equal to..... 3 12s. 11d.
60 per cent., 10d., equal to..... 2 10s. 0d.
per ton in bulk, unground, ex-ship, sampling on discharge, and analysis, the mean of two well-known chemists, agreed upon at time of sale.

The wages paid in the district are approximately :—

Foreman.....\$ 2.50 per day with board.
Miners.....1.25 “ “
Cobbing boys.....50—70 “ “

At several of the mines the miners are paid 30 dols. per month, from which 11 dollars are deducted for board and lodging. During harvest time labor is scarce and difficult to obtain.

The principal mines in Canada are now :—

In the District. Belonging to.
Du Lievre. High Rock, Phosphate of Lime Co. ...
North Star, Dominion Phosphate Co.
Union Mines, Canadian Phosphate Co.
(Star Hill, Crown Hill, Ruby and William.)
Squaw Hill and Aetna, Anglo-Continental Guano Works.
Emerald and Central Lake, Ottawa Mining Co.—Not being pushed.
Little Rapids, W. A. Allen.—Only slightly worked.
Templeton. Blackburn, East Templeton District Phosphate Mining Co.
Ontario....Foxton, Foxton Phosphate Mining Co.
Otty Lake, Bobbs Lake, &c., Anglo-Canadian Co.
Eagle Lake, St. George's Lake, Captain Boyd Smith.

And the total quantities raised were approximately as follows :—

1880 .. 7,500 tons.	
1881 .. 10,307 “	Including 2,402 to U.S.
1882 .. 15,556 “	2,080 “
1883 .. 17,160 “	220 “
1884 .. 20,461 “	32 “
1885 .. 24,876 “	745 “
1886 .. 20,440 “	532 “
1887 .. 23,152 “	733 “
1888 .. 23,290 “	1,000 “
1889 .. 28,198, of which 4,176 exported to U.S.	
1890, estimated 22,000, including a large quantity of second quality.	

The average prices of Canadian apatite, 80 per cent. quality, have been :—

1882.. 17d. with 1-5th rise	1887.. 11 $\frac{3}{4}$ d. with 1-5th rise.
1883.. 16	1888.. 11 $\frac{1}{2}$
1884.. 13	1889.. 12 $\frac{1}{2}$
1885.. 13	1890.. 15 $\frac{1}{4}$
1886.. 12 $\frac{1}{2}$	

the lowest having been in 1888, 11 $\frac{1}{4}$, and the highest 16 $\frac{1}{2}$ in this year.

Having now given a cursory review of the Canadian phosphate mining, we have finally to consider whether we, as consumers of phosphate, can look forward to receiving regular and permanent supplies from the colony, and, in connection with this question, what are the present position and prospects of the industry.

During the year 1888 there was a growing feeling on the part of some of our more important chemical manufacturers that the prospects for our future supplies of raw phosphatic material were not so reassuring as could be wished, and this feeling found expression in a paper “On our Supply of Phosphate for the Manufacture of Super-phosphate,” read before you on December 10th, 1888, by the present president of your Association.

This paper attracted considerable public attention, and served to stimulate enquiries and search after phosphate throughout the world. Canada participated strongly in this awakened feeling. Phosphate lands came rapidly into active demand, and, passing from hand to hand, rushed up in value. Options of even quite undeveloped lands were eagerly sought for, and mine owners were urged to place their properties for sale in the hands of company promoters, who promised to secure for them a high price.

The *Canadian Mining Review*, in its review of the season for 1889, described the position pithily as follows :—“Cables began to pour into Canada asking for offers of land, and in a little while a good portion of the phosphate district was for sale in the London market. Some of the leading mine owners and business men went to the scene of the excitement. Even eminent statesmen started for England with bonds of lands in their trunks, though the reporters were told to announce to the newspapers that the visit was ‘purely a pleasure trip.’ Prospectuses were soon drawn up offering Canadian land to the public at from two to five times the prices asked by the holders, which were generally quite the full value to begin with. An evening paper attacked these schemers, exposing the inflation, and the issues

fell flat. The summer came and the boom collapsed to the sorrow of many landowners, who had been repeatedly told by letter or cable, ‘The thing is done; the scheme is placed; your lands are sold. The company is fully underwritten; it is certain to go.’”

The abortive projects to float several ill-advised extravagant schemes will be within your recollection. This occurred in the spring and summer of 1889. When I was in Canada, in the autumn of that year, although the boom had subsided, the holders of lots still retained exaggerated notions of their value. The belief seemed to prevail among them that Canada is destined some day to furnish the bulk of the world's supply of phosphate, that other sources are dying out, and therefore that the key of the position rests with them. As an illustration of the prevailing idea, I may mention that some days after my arrival at Ottawa, a lady quite unknown to me telephoned to me at the hotel, requesting an immediate interview. As a married man I hesitated, and under pretence of being fully occupied, asked her to write me. It turned out she had a phosphate property, not developed, which she was anxious I should purchase for £4,000, payment on the following day.

It is the custom to speak of Canadian phosphate mining as being quite in its infancy, or as having just got on its legs, but it must be remembered that operations commenced nearly twenty years ago, about the same time that operations commenced in South Carolina, where now about 800,000 tons are annually raised.

In the Somme district, in France, the mining commenced only in 1887, and last year's extraction reached over 200,000 tons.

The Belgian phosphate was first excavated about ten years ago, and over 100,000 tons have been raised annually for some years.

In the Liege district it was started only this year, and over 20,000 will be raised.

In Florida, which, so far as phosphate is concerned, was, in 1888, almost a *terra incognita*, between 20,000 and 30,000 will probably be shipped this year.

In Canada, on the other hand, the output during the past six or seven years has not very materially increased. There are several companies engaged in the industry, with ample capital, using powerful machinery, and having the advantage of some years' experience; but, nevertheless, each mine seems to find it exceedingly difficult to beat previous years' record of 6 to 7,000 tons, and I believe no company has yet succeeded in raising 10,000 tons of cobbled apatite in one year. Indeed it is estimated that the total quantity raised this year, in spite of the high price stimulating the highest possible production, will not much exceed 20,000, of which a large quantity will be second quality.

These considerations lead to the conclusion that the uncertainty and irregularity of the apatite veins and deposits are most serious obstacles against any material augmentation in the whole output, and that, although larger supplies would be very welcome, we can hardly calculate on receiving them.

No doubt very large quantities of the ore exist hidden and buried in the bosom of the rocks, but the difficulties of raising it are very great. It is sometimes necessary to remove hundreds of tons of rock to get at the wished-for phosphate. This difficulty in apatite mining is not confined to Canada, because both in Spain and Norway, where ore of equally high character exists, mining operations were begun more than twenty years ago, but the difficulties have hindered any decided development of the industry.

As you are aware, a new enterprise of some magnitude in connection with Canadian phosphate mining has recently been launched, and it is hoped that it will lead to a rapid and extensive development of the industry. The phosphate placed on the market by it will be welcome, but we must not calculate upon it before it is raised and shipped. If the new concern buys up mines in full working order, the quantity raised will remain approximately the same, because experience has shown that the production of phosphate cannot be forced. Only a few men can work in each pit, and the mining must proceed methodically, carefully and patiently. If undeveloped properties are taken, then some time must elapse before phosphate from them will be shipped, because the development of a mine takes time, particularly in Canada, where the long winter throws such great impediments in the way. Wharves have to be built, roads and tramways planned and constructed, buildings put up, miners engaged—and during summer they are scarce—and machinery transported, &c.

Even if large quantities could be raised, then other obstacles to delivery would intervene. There are already difficulties in getting to Montreal during the short shipping season the quantities raised, and freights across the Atlantic show a tendency to go up. But if, instead of having 20,000 or 30,000 tons to ship, there were double the quantity, the difficulties would become most serious, and the freight across the Atlantic would jump up to a limit which would seriously interfere with the margin of profit.

I will not enter into the financial side of the question

as the success of a Canadian mine depends so much on the amount of capital invested, good management, and favourable position for transport. Some gentlemen in the room can give us interesting and reliable information on this important subject. If the tendency of my paper is to discourage over sanguine hopes, and encourage steady progress in sound undertakings, I shall be satisfied.

To sum up: while we may expect to continue to receive moderate, and, perhaps, slightly increasing supplies of valuable phosphate from Canada, we cannot look for any great increase. When people talk of Canadian shipments reaching 100,000 tons, or other enormous quantities, we remain sceptical, and continue to base our calculations on much more moderate figures.

We all wish success to the Canadian phosphate industry; we hope it will continue to progress steadily, soberly, and satisfactorily—not at one time inflated by wild schemes, resulting in serious prejudice to its real interests, and not unduly depressed; but advancing, year after year, as an industry standing on a solid basis, and meriting the success which we hope it will achieve, and, therefore, I may fittingly conclude my paper in giving expression to the wish—Success to the Canadian Phosphate Industry.

The Chairman expressed the thanks of the Association to Mr. Hutchinson for his well-prepared and interesting paper, delivered, as it had been, under some difficulties. (Mr. Hutchinson was suffering from a severe cold which somewhat affected his voice.) As president of the Association he expressed regret that the prospects of increased supplies of phosphate from Canada were not more encouraging. When asked by Colonial and Continental buyers to supply superphosphates with 18 to 20 per cent. soluble phosphoric acid they must look for raw materials of corresponding quality, and at one time they hoped that Canada would be able to supply large quantities of beautiful high grade phosphates. From a national standpoint it was desirable we should be drawing supplies from our own colonies. The prospects were not so bright as could be wished; still, with sufficient energy and sufficient capital, no doubt a decent supply of Canadian phosphates would always be forthcoming. The paper to which they had just listened had been so exhaustive that it would be difficult to add anything to it, but he hoped some gentlemen present who had just come from the country would be able to supply some additional information.

Mr. Henry F. Moore, editor of *Bell's Weekly Messenger*, said he appeared there rather at a disadvantage, having arrived in London from Canada only the previous day, and having as yet not had time to look at any notes or papers collected during his visit to the phosphate mines. He had brought back some of the latest figures with regard to the industry, and must confess that they hardly agreed with the estimates given by Mr. Hutchinson. In the Lievre district the output for this year was estimated at 30,000 tons, and the figures given him for the same district for last year were 23,000 tons. Mr. Hutchinson's figures, however, were for both the Ontario and Quebec mines, and his were for the latter only. He thoroughly agreed with all Mr. Hutchinson had said in description of the mines; in fact his description had been so complete and accurate that there was nothing more to be said. He also agreed with him in the caution given with respect to Canadian phosphate lands. “Phosphate lands” might mean anything. No doubt many useful mines would be found; but at present many of the so-called “phosphate lands” were mere bush, destitute of any commercial value for mining until they had been explored thoroughly, and likely spots “developed.” Before lands were bought they should be properly developed and the mine started. He thought there was a future before the Canadian phosphate mining industry, but did not see that it would be helped in any shape or form by investments in mere so-called “phosphate lands,” unless the land was developed, and had, in the manner stated, its commercial value ascertained. In addition to that the mines will be economically managed, and by men having a knowledge of the district. Mr. Hutchinson had asked a question as to the discoverer of Canadian phosphate. The discoverer, so far as was known, was an officer of the 15th regiment, Lieutenant Engalls, who was in the district in 1829, and was the first to publicly announce that these were phosphate lands.

Mr. Pickford (Pickford and Winkfield) said his firm sold the first parcel of Canadian phosphate that came to this country, about 1872, and five-sixths of all that was imported until 1880. He could endorse everything said by Mr. Hutchinson, who had exhausted the various points referred to in his paper. He was personally very much opposed to those who held exaggerated views about the future of Canadian phosphate, as, although some parcels shipped have analysed as high as 86 per cent., the average of high quality cannot be estimated over 80 per cent., and in the quantity of Canadian phosphate at present shipped, say 25,000 tons, not more than one-third is of high quality. In 1880 Mr. Pickford first visited the “High Rock” property, at which time there was no regular means of transport; he was rowed in a small

boat against a strong current by three men, and landed on the bank at the edge of a forest, with scarcely a track to guide one to the phosphate shown on the top of the mountain. From that time working the phosphate gradually progressed, although only by hand labor, chiefly surface work which was raised by horse labor and derrick to a depth of 20 ft. to 30 ft., when the various pits were temporarily abandoned for want of machinery which was not introduced until 1884, though only then to a limited extent. Up to that time the only means of transport was by sleigh over the snow in winter, but no possibility of transport in summer, until a steamer was introduced in the river Lievre, to tow the scows (barges) to Buckingham village, a distance of three miles from the Canadian Pacific Railway over very bad roads. Representations were made to the railway company, and in view of facilitating the transport the company constructed the branch line, which, as stated by Mr. Hutchinson, was opened in June, 1885, by His Excellency Lord Lansdowne (the then Governor-General of Canada), accompanied by Dr. Sterry Hunt and Dr. Grant (now Sir Jas. Grant) and Mr. Pickford, as noticed in the *Montreal Gazette* of June, 1885, when on a visit of inspection to High Rock Phosphate Mine, where they were enabled to examine in detail the well systematized operations carried on. At that time the phosphate had to be carted a distance of about two miles to the scows, but since then a tramway has been made, and the transport is organized as well as possibly can be. The difficulty of transport is the great drawback to various properties, many of which can only forward the phosphate on sleighs in winter. Mr. Pickford said he had visited the Canadian phosphate district annually since 1880 (some years twice), having made about twelve journeys, and, being thus conversant with all details, would point out how disastrous may be the incorrect statements put forward in regard to properties that have been offered to the public during the last five years, and what an injurious effect it has had in the Canadian phosphate industry.

Mr. Hunter (Andrew Hunter & Co.) said he had listened with the greatest pleasure to the paper read by Mr. Hutchinson. In the short time at his disposal he had given a particularly interesting and graphic account of the Canadian phosphate industry from its commencement to the present time. At present, primitive modes of working had to a large extent been superseded by more scientific methods, but there still existed considerable difference of opinion as to the most economical method of working the mines. Some could be worked best on the old, and others on the new methods of mining. With regard to the future of Canadian phosphate mining, he must say the remarks made by Mr. Hutchinson were very much to the point. The success of any new enterprise depended on the capital employed and the ability and honesty with which its affairs were managed, and, as far as the Canadian phosphate industry was concerned, any really good mine, fairly and honestly managed, and having a fair slice of luck, would always show profitable results to its shareholders. To manufacturers the most important point was to know what prices would rule next year. An old proverb said: "Never prophesy unless you know." He would not venture upon any rash prophesy, but he thought it was likely that high-grade rock would about maintain its price. The greater supplies from Florida would be counter-balanced by decreasing shipments of high-class phosphate from France.

Dr. Newton (Cannon and Newton) wished to refer to a point in connection with the analysis of pure apatite quoted by Mr. Hutchinson. He thought the figures given for calcium and fluoride, 7.70 per cent., were too high. Pure crystals of apatite contain a little over 93 per cent. of tribasic phosphate of lime, and a little over 4.25 per cent. of calcium and fluoride, the balance being made up of calcium oxide, a singular fact which was first discovered by Mr. Landsdell, of Messrs. Nesbitt, Landsdell, and Co., and afterwards independently carefully worked out by Dr. John Voelcker. Mr. Hutchinson may have been misled by some analysis in which the phosphate of lime was determined, and the calcium fluoride put in by difference.

Mr. H. H. B. D. Shepherd, referring to the question of analysis raised by Mr. Newton, remarked that the pure Canadian apatite crystal was formerly supposed to consist of three molecules of calcium phosphate to one of calcium fluoride, whilst pure Norwegian apatite was held to contain three molecules of calcium phosphate to one of calcium chloride. Subsequent investigations, however, showed that in both descriptions of the mineral calcium chloride and fluoride were found together, and might in fact, be considered to some extent to be interchangeable, though the fluoride preponderated in the Canadian variety and the chloride in the Norwegian, and in all cases the proportion was as three of phosphate to one of fluoride and chloride. Dr. J. A. Voelcker had, however, recently shown that this formula required still further modification, inasmuch as there is present an excess of lime over and above that required by the acids, the chlorine and the fluorine present. The percentages of calcium phosphate and fluoride quoted by Dr. Hutchinson as the composition of apatite in a perfectly pure form were

clearly not intended to represent the actual analysis of any particular shipment, but the theoretical composition of the pure mineral calculated upon the basis of three molecules of calcium phosphate to one of calcium fluoride.

Mr. B. E. R. Newlands (Newlands Brothers) had used Canadian phosphates a great many years ago in the manufacture of superphosphate, and had then considerable trouble in getting the acid to decompose the phosphate. This was owing to the fact that the phosphate was not sufficiently finely ground. Improvements since made in grinding machinery had apparently removed all difficulties connected with the solubility of these phosphates.

Mr. Crowder confirmed the statement of the preceding speaker, and said no difficulty now existed in dissolving Canadian phosphate. The chief difficulty was in getting it into condition when dissolved. The stuff was very apt to become greasy, and would remain in that state a considerable length of time. By using strong acid, however, they could get fairly dry material. It was in bad condition when it first came out of the den, but after a time the condition improved. He might point out the difference between apatite and ordinary phosphate. Ordinary phosphates, such as Somme, Bull River, &c., were sedimentary deposits; that is, they resembled mud in regularity of deposition and distribution. Apatite, on the other hand, resembled various mineral ores, such as copper, &c.; it was found in veins and "pockets," and was most uncertain. A deposit of sedimentary phosphate was, more or less, calculable as to quantity, but a vein of phosphate was quite incalculable. The search for apatite would always be subject to the same uncertainty as the search for minerals that are found in veins, and is quite different from sedimentary deposits. The structure of apatite differs from phosphates, formed by sedimentary deposition, inasmuch as it is crystalline, having distinct lines of cleavage, whereas the sedimentary deposits are generally some kind of hardened mud, without lines of cleavage, and which is tough in grinding (for example, Bull River phosphate). The consequence is that when submitted to blows or pressure, it breaks up with greater facility than Bull River in the milling operations. Comparing apatite with Bull River, we can grind one ton of apatite against only 15 cwt. of Bull River per hour.

Mr. G. M. Bauer having been asked by the chairman to give his experience of Norwegian and Spanish phosphate, said that the mining in Norway seemed to be very similar in character to that in Canada. The Norwegian mines also produce apatite of a crystalline nature, and also rock. The only mine in Norway able to produce largely was the "Bamble," which he believed had worked in the past sometimes at a profit, and sometimes at a loss, but was now yielding good profits. The present outturn amounted to about 6,000 to 8,000 tons of high-class phosphate, analysing 82 to 90 per cent. tribasic phosphate, nearly the whole of which was shipped to Germany, where it commanded extraordinarily high prices. In addition to the high grade phosphate, they obtained about 5,000 tons about 65 per cent to 70 per cent., which contained only about 3 per cent. iron and alumina, and was workable. Besides that they obtained another quality 55 per cent. to 60 per cent. Considering that a very good gross profit was realized on the high-class phosphate, it looked for the present like a very remunerative enterprise, but the former outlay in deadwork machinery and on means of transport to place of shipment, if not amortized, must of necessity sensibly influence net profits. With regard to Spanish Estremadura phosphate his experience had been of a doubtful character. The average analysis of these phosphates was about 50 to 60 per cent. He had heard of cargoes testing 80 per cent., but the quantity of such high-grade material in Spain was extremely limited. When the very low prices of Charleston prevailed, viz., about 7d., the mines with which he had been connected had been obliged to stop mining, and they were not working at the present moment. He believed that in Estremadura there were deposits of high-class phosphate which it might pay to work if there was a surety of a large quantity, but so far the quantity had failed. There were two distinct qualities in Estremadura, one in which nearly all the impurities consisted in carbonate of lime, and the other in which silica formed the chief impurity. The phosphate was generally very free from iron and alumina, and very workable, and would doubtless be used freely provided it could be obtained in sufficient quantities, and this depends on prices remunerative to raisers. All shipments were made from Lisbon, and during some years were very considerable, and exceeded 50,000 p.a. There are phosphates in Spain which have been put on the market as Spanish phosphates, but should not be confounded with Estremadura, inasmuch as they contain a rather large percentage of iron and alumina, which, as already stated, is not the case with Estremadura. These inferior deposits are in the south, and shipments are made at Seville, and are likewise not worked at present.

The Chairman said that as manufacturers they were ready to receive any quantity of high-class phosphate from Canada. They could grind it, and, as they had heard, there was no difficulty in making it into super-

phosphate, and he was quite sure the chemists were prepared to analyse it. One thing to which, as manufacturers, they objected was the 1-1-5d. rise per unit in price. Another thing was the uncertainty as to time of delivery of Canadian phosphates. It was generally sold for shipment during the shipping season which extended from about May to November. He thought that in all contracts the time of shipment should be more closely defined. Another point was that if 80 per cent. was sold, 80 per cent. should be delivered, not 78 or 79 per cent.

Mr. Hutchinson briefly replied. With regard to the quantity of Canadian phosphate which will be raised this year, his estimate of which was queried by Mr. Moore, he had derived his figures from shipping agents in Montreal, who were more likely to be right than the mining captains, who are usually of a sanguine temperament. As to the analysis of pure phosphate, he took his figures from a work on phosphates by George Jones, F.C.S., and gathered from Mr. Shepherd's remarks that the analysis was theoretically correct.

Mr. Anderson moved and Mr. Pickford seconded a vote of thanks to Mr. Hutchinson, which was carried with acclamation, and the proceedings then terminated.

MacArthur-Forrest Process of Gold Extraction.

(Mr. J. S. MacArthur in the *Journal of the Society of Chemical Industry*.)

The author describes briefly a number of the different mechanical and chemical processes hitherto in use, by which the metal has been separated from the ore. After experimenting on ores from all parts of the world, the inventors adopted the following process, which may be stated in the author's words:—"The ore is ground to about the fineness of sand. If, instead of ore, we are working tailings from the amalgamation process, these are generally not re-ground, but treated as delivered. The finely-divided material is mixed with a solution of cyanide, say cyanide of potassium, containing on an average 0.4 per cent. of cyanogen as the cyanide of potassium or other alkali or alkaline earth. The ore and solution are stirred together for six hours, more or less; and when the gold is known to be dissolved, the pulp is discharged into an ordinary filtering tank, where the filtration may, if necessary, be assisted by suction, and where the ore is washed by water or by the waste cyanide solution from a previous operation. The ore, after treatment with cyanide solution, is unchanged to the eye, as almost nothing but the imperceptible proportion of gold present has been removed. The gold now being in solution, the next object is to get it precipitated, and here we encounter a serious difficulty. Gold and cyanogen have such a strong mutual affinity that it is difficult to get any substance that will separate them. The gold cannot be precipitated by any ordinary method, such as the use of ferrous sulphate or oxalic acid; even sulphuretted hydrogen and sulphide of sodium will not precipitate gold from its cyanide solution, though they precipitate silver. We had noticed, however, by experiment, that zinc precipitated gold very feebly, and tried this in the same way that copper is precipitated from its ordinary solutions by scrap iron, but scrap zinc had no effect; then granulated zinc was tried, with a most imperfect and disappointing result; then heating in presence of scrap and granulated zinc, but this had only the effect of forming urea, and assisting the precipitation very little indeed. Further, we tried zinc dust, but still there was no success. Finally we prepared some zinc in a form like saw-dust, porous, and with a large surface of bright metal. On allowing the cyanide of gold solution to trickle through a mass of the zinc we found that it trickled out gold free, and, better still, we found that the action became more vigorous and pronounced after a portion of the gold had been precipitated on it, doubtless as gold and zinc formed together a more powerful electro-chemical precipitant than zinc by itself. An arrangement of a porous mass of zinc like a sponge formed a chemical filter, which at once precipitated and collected the precious metal; indeed, so like an ordinary water purifying device was this zinc filter that many non-technical visitors formed and held tenaciously to the idea that the gold was in suspension in the cyanide solution, and the zinc was used merely because of its durability. Improvements in detail were made in the direction of increasing the surface, and decreasing the weight of the zinc, till now we have it in threads, 1 lb. of which occupies about two gallons measure. The zinc in this form is possessed of enormous chemical activity of which the strongest and most direct evidence is the fact that it burns in the air like thin shavings of wood. When the gold has been deposited, it is necessary to separate it from the excess of zinc present. The filiform structure of the zinc, and the exceedingly fine powder, as which the gold is deposited, render this an easy matter. The filiform mass of zinc, with gold powder adhering, is vigorously shaken in water, and the gold falls off, and the fibrous particles of the zinc may be collected in a sieve. The gold settles easily, is collected, and fused directly into bullion."



MINING NOTES.

Nova Scotia.

The Local Legislature are preparing a representative exhibit of the minerals of the Province for the Jamaica Exhibition.

The Canadian Smelting and Refining Company is the name of a new concern seeking incorporation. Capital \$100,000. Head office: Yarmouth, N. S.

Another new company, the "Canadian Smelting and Refining Company," is also seeking incorporation. Directors: E. K. Spinney, J. R. Wyman, E. F. Clements. Authorized capital, \$100,000. Head office, Yarmouth, N.S.

Application for incorporation under the Joint Stock Companies' Act has been made by the "North Star Mining Company." Capital \$40,000. The incorporators are: H. K. Fisher, Isaac's Harbor; R. Macdonald, W. G. Brookfield, W. H. Johnson, W. M. Cameron, all of Halifax; George Whitelake, Mason, N.H.; and G. W. W. Churchill, of Hantsport, N.S.

The coal miners of Nova Scotia are endeavouring to secure the eight-hour system. In accordance with resolutions passed at a meeting of the Grand Council, at Pictou, recently, it has been decided to apply at the next meeting of the Legislature of Nova Scotia for a law providing that eight hours per day be the fixed time of labor in all the coal mines of the Province. Another subject of discussion by the Grand Council was the "boys and education." The result of the discussion was the adoption of the following resolution: That the Legislature be asked to enact that, "No boy under the age of twelve years shall be permitted in or about a coal mine, and no boy of 12 years or over shall be permitted to go to work unless he be able to read, write and count as far as fractions." The passage and enforcement of such a law would do a great work for the sons of miners. Under its operation every father would be compelled, by self-interest, to send his sons to school.

Pictou County.

Mr. T. Turnbull and others are opening up the old Haliburton mine, near the Vale Colliery.

Messrs. John Muir & Sons have fully recovered from the effects of their recent fire, and are raising coal again at East River.

The Foord pit is slowly being repaired and opened up. Preparations are being made to erect coke ovens here, the coal from the pit having a very high reputation for coking purposes.

The drift from the Douglas Slope to the Cage-Pit Seam is almost completed, and we may expect to see coal coming from this seam by the Douglas Slope early in the new year.

At the Drummond Colliery the foundations are being put in place for a new and powerful winding engine on surface, which will enable them to raise all their coal to bank in one lift instead of two as at present.

The New Glasgow Coal, Iron and Railway Company has purchased a site at the Forks of the East River, for its blast furnace.

Gold Mining Supplies.

The principal depot in Nova Scotia, carrying the most complete assortment of first class goods, is

H. H. FULLER & CO'S
41 to 45 Upper Water St., Halifax, N.S.

Our line comprises Explosives, Fuse, American and English Mill and Hammer Steel, Bar and Bolt Iron, Steel Wire Hoisting Rope, Hemp and Manilla Rope, Rubber and Leather Belting, Miners' Candles, Oils and Lamps, Miners' Tools, Machinists' Tools, Blacksmiths' Tools, and every requisite for the gold miner.

H. H. FULLER & CO.,
Halifax, NS.

Cumberland County.

The shipment of coal from the pits of the Cumberland Railway and Coal Company aggregated fully 50,000 tons, while the gross output, including quantity used for colliery consumption, will carry the amount to at least 54,300 tons. It is noteworthy that whereas the number of men employed in 1887 to get about 43,000 tons was over 1,500, there are only about 1,200 men and boys employed at present, so that this increased output means considerably more to each person employed than formerly. Springhill is recovering rapidly from its late troubles.

Long-wall working was commenced at the Joggins colliery six or seven weeks ago, and it is apparent to all concerned that the system might have been introduced with benefit long ago. The output from the mine has largely increased and the quality of the coal has improved. A number of improvements and repairs are being made to workings here.

Waverly District.

The Windsor Junction Mine, operated by "The Nova Scotia Syndicate, Limited," has just put in a new twenty horse-power engine and boiler. Mr. G. Macduff, the manager, states that it is the intention of the syndicate to sink the shaft when the new plant has been located to a depth of from 400 to 500 feet, and test the ground by cross-cuts and drifts. Little else than development work will be done this winter.

The Lake View Company cleaned up for the first time on the 31st October. No weights of the material crushed were kept, but the Superintendent, A. A. Hayward, estimates 1,000 tons passed through the mill. The resulting gold bar weighed only 97¾ ounces, or an average per ton of about \$1.90. Considerable vibration is observed in the mill when running, and is due to the design of the structure, which is modelled after a mill built in Maine during the silver excitement there some years ago. Whether the vibration is sufficient to cause any material injury is a matter for time to tell. The structure is said to be the finest mill ever built in Nova Scotia, and to have cost over \$16,000.

Cape Breton.

The Bras D'or Marble Company is making a large outlay on channelling and other quarry machinery. It expects to begin shipping marble in the spring. Its lime works have been enlarged during the past season, but have not been able to meet the demand.

Assays of average ore samples from late developments at the Coxheath Copper mines show the following results: Sample from 250 feet level of vein B, on hanging wall side, copper 12 per cent., gold 0.21 ounces per ton, silver 2.75 ounces per ton. Sample from middle of vein B, copper 6.4 per cent., gold 0.10 ounce per ton, silver 1 ounce per ton. Sample from foot wall, vein B, copper 14 per cent., gold 0.23 ounces per ton, silver 2.5 ounces per ton. Sample from bottom of shaft No. 3, new vein, copper 13 per cent., gold none, silver none. No. 3 shaft was only down 21 feet when sampled, and the precious metals are not looked for until further depth is attained.

Killag District.

Advices from this district are to the effect that the property of Mr. Stuart, et al, has been sold to an American syndicate; the price is not made public.

South Uniacke.

This district is very quiet. The Withrow property is not working to any extent, and no returns have been made from the Thompson property for some months.

Oldham District.

The mill of the Oldham Gold Company is building slowly; all the machinery is on the ground excepting the water-wheel, and the management do not set any date for completion. The old mill is still in commission and will be until the new one starts up.

The Standard Gold Company have their new hoisting engine at work and everything is in readiness for the Rand compressor, which is nearly a month overdue. The new pumping plant will be put in in December, and the management hope to have all the new machinery in operation January 1st, 1891.

Whiteburn District.

It is reported that the mine owned and operated by Evans & Parker has been closed down on account of ore being too low grade to pay.

The accounts of the "Graves" mine have been settled in full, and some work is now being done under the direction of Mr. Geo. J. Partington, formerly with the Oxford Co. at Lake Catcha.

Malaga District.

The mill of the Boston Gold Mining Co., Mr. Baldwin, superintendent, is rapidly being completed, and the stamps are expected to be dropping in December. The quartz upon this property is reported as richer than upon the other properties in the district, but as few mill tests have been made the statement may be premature.

The Parker-Douglass Co. have curtailed work and discharged twenty men; the mine has been working for over two years, but upon very low grade ores and the results have been discouraging.

Wine Harbor District.

The mill now building by Mr. McNaughton upon the Caledonia property is nearly ready to run. The "Middle Lode" property, leased from Mr. Harding and associates, by Mr. McNaughton, yielded 128 ounces last month from 300 cart loads, an average of over \$12 to the ton. As the belt worked exceeds eight feet in thickness the margin for profit is a large one.

Mr. Harding is now doing some development work upon the "Judge Henry" property at the eastern end of the district.

Quebec.

We hope in our next issue to be able to publish full returns of the exports of Canadian phosphates.

A special general meeting of the shareholders of the Templeton and Blanche River Phosphate Company has been called for Monday, 1st December.

The Phosphate Corporation, Limited, has commenced active work on the Stewart properties. We are indebted to Mr. J. Lanson Wills, manager of the company, for a very unique and handsome little photographic souvenir of the recent opening of the High Falls property. This tastefully designed little booklet contains the following views:—1. Group seated on debris of first blast; 2. Passenger boats on the Lievres; 3. Government works at the "Little Rapids;" 4-5. Long Rapids; 6. The High Falls.

The Montawa Gold Mine Company is the latest company seeking incorporation under the Companies Act of the Province. The authorised capital is \$24,000, divided into shares of a value of \$10 each. The first directors are: Ed. Guilbault, A. Magnan, A. Cabana, J. Rivard, J. H. Renaud, Hon. J. A. Ouimet, J. A. Renaud, J. H. Ostigny, all of whom, excepting the Hon. J. A. Ouimet, are of the town of Joliette. The chief place of business will be at Joliette.

Coke-Making in Australia.

At Fort Pirie, on Spencer's Gulf, South Australia, the manufacture of coke for smelting silver from the Barrier silver mines has become a well established and growing industry, and the quality of the product compares favorably with that of the English cokes heretofore used for the purpose. The town owes its advancement in manufactures to the completion of the narrow gauge railway recently built from it to Broken Hill, there being now in the town the smelting works of the British Broken Hill Company, the refining works of the Proprietary Company, and the coke works above referred to owned by the British and Australian, and the Westport companies.

The coal used in making coke at these works is all crushed by being passed through a Carr's disintegrator before being taken to the ovens. As the coal leaves the disintegrator it is carried by an ordinary conveyor belt to a series of elevated bins, having a capacity of some 230 tons; from these bins it is drawn through chutes into laries running along over the tops of the coke ovens. There are at present 42 ovens in operation, 30 by the British and Australian Coke Company, on the Intercolonial wharf, and 12 at Solomontown by the Westport Coke Company, the monthly output being between 300 and 400 tons, an amount too small to meet the present demand.

No attempt has yet been made to use any of the by-products. The ovens are not of uniform size, and have been built at different times. The original ovens were twice blown down and had to be rebuilt, while the latest additions erected under the management of Mr. F. J. Jones, are of greater size than those put up at the start. Ten of these ovens carry charges up to 10 tons, though the average charge is about 8 tons, the time occupied in burning being about 48 hours. The necessary iron work and bricks for 10 more of the same size are on the spot, but so far the work of construction has not been commenced. The remaining 20 ovens carry from 3 to 5 tons and take about three days to finish the process, the 12 ovens at Solomontown being of the same size. The coke

made at these works is admitted by practical men to be of a very superior character. The coal coming from New Zealand, contains about $\frac{3}{4}$ per cent. of dust, while the coke averages 2 to $2\frac{1}{2}$ per cent. of ash. This compares very favorably with the English cokes, that made in Newcastle averaging 4 per cent. of ash, some of the Lancashire 2.70 per cent. and the Welsh 3.26 per cent. while some of coke which is imported in the colony runs from 4 to 7 per cent. of ash.

Alloys of Nickel.

Hitherto in the manufacture of the binary alloys of nickel and iron, known as ferro-nickel and steel-nickel, either metallic or pure nickel, or the crude nickel or nickel mattes, derived from the smelting of oxidized nickel ores carried on only up to the point where the elimination of the iron would begin, are employed. The first of these is, however, expensive, and, on the other hand, crude nickel contains a considerable amount of foreign matter, which is not desirable.

An invention by H. Marbeau, of Paris, consists in the manufacture and employment for the production of ferro-nickel or steel-nickel of a carburetted alloy containing nickel, iron and manganese obtained by the reduction of oxidized nickel ores with iron ores and manganese ores, preferably in a blast furnace. This alloy, which might be called nickelo-spiegel, is cheaper than pure nickel, and is purer than crude nickel. The proportion of the three ores will vary according to the percentage of the three metals required in the carburetted alloy. The following may be given as an example: Nickel ores (10 per cent. nickel), two tons; iron ores (50 per cent. iron), 12 cwt.; manganese iron ores (10 per cent. manganese and 40 per cent. iron), one ton. In the employment of this nickelo-spiegel for the production of ferro-nickel or steel-nickel the nickelo-spiegel can be treated in a converter so as to obtain steel-nickel or ferro-nickel containing the required percentage of nickel. The presence of the excess of manganese in the nickelo-spiegel permits of obtaining the heat necessary for the good working of the operation in the absence of silicium.

Apatite in Sweden.—The apatite discoveries in Northern Sweden, especially in the Gellivara district, continue to attract much attention, and have of late been examined and reported upon by a special committee. The members of this committee have now completed their report, but do not agree on all points. One of the experts holds that the apatite is in general so closely combined with magnetic iron ore, that it will be necessary to grind the ore, and separate the iron magnetically, but it is a question whether crushed iron ore is fit for the production of pig iron, at least so far as large and high blast furnaces are concerned. The largest deposits of iron ore and apatite contain from a few per cent. up to 10 or 11 per cent. of the latter; there is, however, also an ore in considerable abundance which contains 19 per cent. of apatite, and, finally, one which contains as much as 60 per cent. of apatite, but as to the extent of which no definite information has as yet been obtained. Another member of the committee is of opinion that the apatite itself is sufficient to make the breaking and further handling remunerative. The residue can, however, be subjected to further treatment, either a further crushing and separation, or smelting down with lime or quartz for the purpose of obtaining Thomas slag and phosphoric iron for the basic Martin process. The question of the apatite and other resources of Northern Sweden will, however, not be allowed to drop, and a large party of Swedish M. E.'s have lately visited these districts to examine matters for themselves.—*Engineering*.

Brickmaking in Bagdad.—The British Consul General at Bagdad, in his latest report, states that there are about twenty-five large and small kilns at work at Bagdad in the hands chiefly of Jews and Christians, but the turnout is far behind the demand. The kilns are dotted over the desert outside the city. The usual prices of bricks at the kiln side are £1 16s. per 1,000 of 12 in. square, and 18s. per 1,000 of 7 in. square. The bricks are carried from the kiln on small donkeys, each taking not more than ten large or twenty-five small bricks. In the course of transit they get much broken, as the best, though good to look at, and of a chrome yellow color, are very brittle. Another great promoter of the demand for bricks is the absorption of water every winter, bricks suffering equally with the mortar in which they are laid, owing to their porousness. Thus, there is hardly a house, or wall, or brick pathway in Bagdad which does not constantly call for patching or rebuilding with new bricks. The old city walls, thrown down about 1870 by Midhat Pasha when Governor-General, remain still, in spite of years of burrowing and abstraction, a mine of broken bricks. Under a late regime it was said that the right of taking these away and selling them was conferred as a substitute for pay on the soldiery; but at present all classes seem to help themselves to them. These remarks serve to show what a good opening there is in Bagdad for brickmaking after some simple but scientific method.

Annotated List of Canadian Minerals.*

G. C. Hoffman, F. Inst. Chem., etc.

Continued from page 145.

63. CERUSSITE—Has hitherto been met with only in small earthy masses and incrustations, associated with the galenite of certain localities in British Columbia.

64. CHABAZITE—Is found in large and very perfect crystals at Swan Creek (Cumberland Co.), Mink Cove and Sandy Cove, Digby Neck, and Williams' Brook (Digby Co.), and Pinnacle Island (Colchester Co.), in the Province of Nova Scotia. See also note to "Acadialite."

65. CHALCEDONY—Is found in many parts of the trap district of Nova Scotia, where, according to Dr. How, an almost unique blue chalcedony is found on the coast between Capes Split and Blomidon (King's Co.), and a very fine milk-white chalcedony near Trout Cove, Digby Neck (Digby Co.). It occurs of an olive green colour, in small veins, on Belanger's Island, lying off the entrance to Richmond Gulf, eastern coast of Hudson Bay; in thin bands or veins, with Jasper, on the River Ouelle (Kamouraska Co.), in the Province of Quebec. In veins in the amygdaloidal traps of Lake Superior, Province of Ontario, and elsewhere in Canada.

66. CHALCOCITE—Is found, most frequently in association with chalcopryite, or chalcopryite and bornite, in the townships of Leeds and Halifax (Megantic Co.), Brome, Sutton, (Brome Co.), Shefford, Stukeley (Shefford Co.), Melbourne, Cleveland, Brompton (Richmond Co.), Acton (Bagot Co.), and Tingwick (Arthabaska Co.), in the Province of Quebec—at the Canada West mines on Lake Huron, and Prince's location, Lake Superior, in the Province of Ontario.

67. CHALCOPYRITE—Is widely distributed throughout many of the Eastern Townships of the Province of Quebec. In some of them it is occasionally met with unaccompanied by other ores of copper, but it is more frequently associated with chalcocite or bornite, or both. The more important localities lie in the townships of Bolton, Brome, Sutton (Brome Co.), Leeds, Halifax (Megantic Co.), Stukeley (Shefford Co.), Ascot (Sherbrooke Co.), Acton (Bagot Co.), Cleveland, Melbourne (Richmond Co.), Chester (Arthabaska Co.), and Ham Wolfe Co. Other noteworthy localities are—the township of McKim, and adjoining townships, in the District of Nipissing; the West Canada mines, Lake Huron, and Point-aux-Mines and other places on Lake Superior, in the Province of Ontario.

CHIASTOLITE—Occurs in a fine grained micaceous schist at Moore's Mills, Charlotte County, Province of New Brunswick; and in the somewhat micaceous argillites on Lake St. Francis in Beauce County, Province of Quebec.

CHLORITE (PENNINITE)—Occurs, most frequently, in admixture with other minerals, forming beds of chloritic slates as in Bolton (Brome Co.), Shefford (Shefford Co.), Ascot (Sherbrooke Co.), Cleveland and Melbourne (Richmond Co.), and other Eastern Townships of the Province of Quebec. In some of these townships, however, as for instance those of Potton and Bolton (Brome Co.), and Broughton (Beauce Co.), beds of pure compact chlorite are met with, and occasionally, as in Cleveland (Richmond Co.), the chloritic slates are traversed by thin well defined veins, which are filled with pure scaly chlorite. Anal., T. S. Hunt, Geol. Can., 1863, p. 607.

70. CHLORITOID—Is of common occurrence in the micaceous schists of the Eastern Townships, in which it is disseminated in small grains and crystalline plates, or small lamellar and spherical masses. It is thus found in the townships of Leeds (Megantic Co.), Brome and Sutton (Brome Co.), in the Province of Quebec. Anal., T. S. Hunt, Geol., Can., 1863, p. 498.

71. CHONDRODITE—Is often met with in the crystalline limestones of the Laurentian series. It is found, in grains, in the limestones of St. Jérôme (Terrebonne Co.); in a magnesian limestone in Aldfield (Pontiac Co.), Province of Quebec—and, with small scales of graphite, in a white crystalline limestone near Newborough in North Crosby, also in South Crosby (Leeds Co.), in the Province of Ontario, and elsewhere in these provinces.

72. CHROMIFEROUS GARNET—A very beautiful emerald-green chromiferous garnet occurs, in granular masses and minute crystals, thickly disseminated through a vein of white cleavable calcite, on the east side of Brompton Lake, in the township of Orford (Sherbrooke Co.), and a very similar garnet is found, associated with apatite, pyroxene, calcite, orthoclase, tourmaline and idocrase, in the township of Wakefield (Ottawa Co.), Province of Quebec. Analyses, T. S. Hunt, Geol., Can., 1863, p. 497; B. J. Harrington, Can., Nat., 2 ser., vol. ix, p. 305, 1881.

73. CHROMITE—Is found in pockets, scattered through serpentine, at Mount Albert, Shickshock Range (Gaspé Co.), and in considerable quantity, in connection with serpentine and other magnesian rocks of the Quebec group in the townships of Bolton (Brome Co.), Ham and Wolfstown (Wolfe Co.), and Leeds (Megantic Co.),

in the province of Quebec. Analyses, T. S. Hunt, Geol. Can. 1863, p. 504.

74. CHRYSOCOLLA—Is found sparingly amongst some of the copper ores of Lake Superior, province of Ontario.

75. CHRYSOLITE—Occurs in the form of grains, and occasionally as ill-defined crystals, in a dark grey dolerite, near South Lake (Antigonish Co.), province of Nova Scotia. In well defined green crystals, and olive or amber colored imperfect crystals, and small honey-yellow grains, in the eruptive rocks of Rougemont (Rouville Co.), Montarville (Chambly Co.) and Montreal (Hoche-la Co.); in red angular masses in a dyke at St. Anne's (Jacques Cartier Co.), and of a pale yellowish to greyish-green color, forming rock masses at Mount Albert, Shickshock Range (Gaspé Co.), in the province of Quebec. Olivine has also been detected in several of the eruptive rocks of British Columbia. Analyses, T. S. Hunt, Geol. Can., 1863, p. 464; B. J. Harrington, Rep. Geol. Can. 1877-78, p. 39 G.

76. CHRYSOTILE—Often constitutes seams, sometimes nearly seven inches thick, in the serpentine of the Eastern Townships of the province of Quebec: the more important localities comprising—the townships of Thetford and Coleraine (Megantic Co.), Shipton and Melbourne (Richmond Co.), Ham (Wolfe Co.), Broughton (Beauce Co.), and Bolton in Brome county. Analyses, E. G. Smith, Am. Journ. Sci., 3 ser., vol. xxix, p. 32, 1885.

77. CINNABAR—Occurs, *in situ*, sparsely disseminated through a fine crystalline granular limestone, at the Ebenezer mine, Hector (Kicking Horse) Pass, Rocky Mountains, British Columbia.

78. CLAY IRONSTONE—Is found everywhere in the Coal Measures of Pictou county, Nova Scotia, in irregular beds from five to forty inches thick. Occurs in layers and nodules, in connection with a small seam of coal at Gaspé, province of Quebec. Is widely distributed in the North-west Territory, in some localities in considerable abundance, in the form of nodules and nodular sheets. Analyses, G. C. Hoffmann, Rep. Geol. Can., 1880-82, p. 8—12 H.

79. COCCOLITE—A greenish-grey granular pyroxene or coccilite, occurs in the township of Portland, and the same mineral, of a pale green color, is met with in adjoining township of Buckingham (Ottawa Co.), province of Quebec.

80. COOKEITE—A micaceous mineral having all the blow-pipe characters of, and which may prove to be identical with, Cookeite was found sparsely disseminated through a specimen of galenite from Otter Tail Creek, province of British Columbia. Annual Rep. Geol. Can., vol. 2, p. 10 T., 1886 (where, however, the locality is erroneously given—read as above).

81. COPPER—NATIVE.—Is found, in the form of grains and irregular shaped masses, occasionally several pounds in weight, in veins and fissures traversing the trap at Cape d'Or and Spencer's Island (Cumberland Co.), Five Islands (Colchester Co.), Margaretville (Annapolis Co.), Briar Island (Digby Co.), and many other places in this section of Nova Scotia. More abundantly, however, in the province of Ontario, occurring in fine particles, filaments, grains or masses, the latter sometimes more than one hundred pounds in weight, in amygdaloidal traps and greenstones, in veins and fissures traversing these, and in sandstones associated with the same, in many localities on the north and east shore of Lake Superior, some of the more important of which are—Battle Island, the Islands of St. Ignace and Michipicoten, also at Mamainse and Cape Gargantua.

82. CORACITE—Is said to form a vein about two inches in width, at the junction of the trap and syenite, at Mamainse, east side of Lake Superior, province of Ontario.

83. CORUNDUM—Has been found in small light blue crystals imbedded in crystalline Laurentian limestone, also in rose-red to sapphire-blue grains, disseminated through a rock made up of felspar, quartz, calcite, mica and sphene, in the township of Burgess (Lanark Co.), province of Ontario.

84. COVELLITE—Occurs in nodular form, with nodules of more or less altered chalcocite, at New Annan (Colchester Co.), province of Nova Scotia. Analyses, H. Louis, Trans. N. S. Inst., vol. iv., p. 427, 1878.

85. CRYPTOMORPHITE—Is found, in conjunction with ulexite, Howlite, mirabilite, halite, Arragonite, calcite and selenite, in gypsum depo its at the Clifton quarry, Windsor (Hants Co.), province of Nova Scotia. Anal., H. How, Am. Journ. Sci., 2 ser., vol. xxxii, p. 9, 1861.

86. CUPRITE—Has been found, in association with a little native copper and blue and green carbonate, in quartz, at Spencer's Island (Cumberland Co.),—the collector, Mr. C. W. Willmott, informing me that it occurs, *in situ*, at Bennet's Brook, one mile east of Horse-shoe Cove, and at intermediate points between that and Cape d'Or, one mile west of Horse-shoe Cove (Cumberland Co.), Nova Scotia. Also occurs, but in small quantity only, in some of the copper deposits of the Eastern Townships of the province of Quebec, as at Acton (Bagot Co.), where it has been observed in the form of cinnabar-red stains upon blackish shales.

87. CYANITE—Occurs in the form of radiated colum-

nar aggregates of a pure blue, light bluish-grey and greenish-grey color, imbedded in a granular quartz, on the North Thompson River, British Columbia. Anal., G. C. Hoffmann, Rep. Geol. Can., 1878-79, p. 1 H.

88. **DAWSONITE**—Occurs in the joints of a white felspathic dyke, cutting the Trenton limestone, near the western end of McGill College, Montreal (Hochelaga Co.), province of Quebec. Anal., B. J. Harrington, Can. Nat., 2nd ser., vol. vii, p. 305, 1875; see also vol. x, p. 84, 1883.

89. **DIALLAG (HYDROUS)**—Small masses of a pearly, translucent, celadine-green diallag, occur in a rock in the township of Orford (Sherbrooke Co.), and a coarsely cleavable, bronze-colored variety of diallag, forming a rock, is met with in the township of Ham (Wolfe Co.), province of Quebec. Analyses, T. S. Hunt, Geol. Can., 1863, p. 469.

90. **DIOPSIDE**—See note to "Malacolite."

91. **DOG-TOOTH-SPAR**—Large scalenohedrons of calcite have been found at the Bruce and Wellington mines on Lake Huron, also at the Silver Islet and Duncan (formerly Shuniah) mines (at the last named, Professor Chapman observed, in a *vug*, a bunch of crystals many of which measured upwards of eighteen inches in length), Thunder Bay, Lake Superior, province of Ontario. Good specimens of dog-tooth-spar are also found at Tenny Cape (Hants Co.), Black Rock (King's Co.), Partridge Island and Two Islands (Cumberland Co.), etc., in the province of Nova Scotia.

92. **DOLOMITE**—In the form of rock-masses, is of very common occurrence in Canada. Besides forming great beds among the Laurentian limestones, dolomites make up the chief part of the so-called Calciferous formation, and are developed on a great scale in its geological equivalent, the Quebec group. The so-called limestones of the whole of the Middle and Upper Silurian series in Ontario are, with few exceptions, dolomites, including the Clinton, Niagara, Guelph, and Onondaga formations. See also note to "Pearl-spar."

93. **DOMEYKITE**—Has been found, in admixture with niccolite, in a vein cutting a bed of amygdaloid on Michipicoten Island, Lake Superior, province of Quebec. Analyses, T. S. Hunt, Geol. Can., 1863, p. 506.

94. **ELAEOLITE**—Is mentioned, by Dr. Hunt, as occurring in orange-red grains, with black hornblende, in a white felspathic rock, which is found in boulders on Pic Island in Lake Superior, province of Ontario.

95. **EPIIDOTE**—Characterizes large portions of the metamorphic rocks of the province of Quebec, in many parts of which occur beds which are entirely made up of quartz and epidote; sometimes in distinct grains, at other times forming a homogeneous, generally pale green, very tough and sonorous rock. Characteristic specimens of this rock are met with in the township of Melbourne (Richmond Co.), but beds of the same occur in numerous localities in this section of the province. This mineral has been met with in the crystalline form, in a concretionary epidotic rock, at St. Joseph (Beauce Co.), province of Quebec; also in some of the amygdaloidal traps and greenstones of Lake Superior as— at Mamainse, where crystals of the same are found implanted upon mesolite—in the province of Ontario.

96. **EPISTILBITE**—Is found with stilbite on ledges of trap at Margareville, about seven miles east of Port George, Annapolis county, province of Nova Scotia. Analyses, H. How, Am. Journ. Sci., 2 ser., vol. xxvi, p. 33, 1858.

97. **EPSOMITE**—Occurs at the Clifton gypsum quarry, Windsor, Hants county, province of Nova Scotia. As an efflorescence on the black shales of Utica formation near Montreal (Hochelaga Co.), and upon the black shales of Quebec (Quebec Co.), province of Quebec. As an efflorescence on a serpentine rock near the iron-ore bed of Crow Lake in Marmora (Hastings Co.), and as a crystalline incrustation upon sheltered surfaces of the dolomites at various points along their outcrop from Niagara Falls to Lake Huron, and near Niagara is said to be found, with gypsum, in geodes in the rock—province of Ontario. Also occurs, in association with mirabilite, as an incrustation upon the cliffs of shale at Fort St. John, Pease River, British Columbia. Anal., G. C. Hoffmann, Rep. Geol. Can., 1875-76, p. 421.

98. **ERYTHRITE**—Is found as a rose-red incrustation on calcareous spar, at Prince's mine on Lake Superior, province of Ontario.

99. **ESSONITE**—Occurs, in small crystals with crystals of idocrase, pyroxene and zircon, in calcite at Grenville (Argenteuil Co.), and both massive and crystallized, in the townships of Portland and Wakefield (Ottawa Co.), in the province of Quebec.

100. **FAHLUNITE**—Is mentioned, by Prof. How, as occurring in granite on the road between Windsor and Chester, Hants county, province of Nova Scotia.

101. **FASSAITE**—A black, occasionally blackish-green, pyroxene from the township of Templeton (Ottawa Co.), province of Quebec, would seem, from its chemical composition and other characters, to be referable to this variety. Anal., B. J. Harrington, Rep. Geol. Can., 1877-78, p. 17 G.

102. **FLUORITE**—Occurs, in green octahedral crystals,

with barite, lining fissures in porphyry on an island three miles east of Gravelly Point; in green cubes, associated with quartz and calcite, at Prince's mine; of a purple color, filling veins in syenite, on the main land opposite Pic Island, and also, with calcite, in amygdaloid three miles east of Cape Gargantua; in cubes two or more inches in diameter, associated with large crystals of amethyst, in *vugs* in the large irregular veins in the syenite at the mouth of McKenzie's River, Thunder Bay; in veins near Black Bay and Terrace Bay; on Flour Island in Neepigon Bay, and elsewhere on Lake Superior, province of Ontario.

103. **FREIBERGITE**—An argentiferous tetrahedrite, associated with some galenite and sphalerite, in a gangue of quartz, is found at Cherry Creek, thirty-three miles east of the head of Okanagan Lake, province of British Columbia.

104. **GALENITE**—Is very widely distributed throughout Canada: both in interstratified masses, veins, and small crystalline aggregations, etc., scattered through rocks of various kinds. Some of the most noteworthy localities of its occurrence are situated—in the counties of Carleton, Lanark, Leeds, Frontenac, Hastings, and, Peterborough, and on the north shore of Lake Superior, as at Prince's Mine, Thunder Cape, and Point des Mines etc., in the province of Ontario. Extensive deposits of galenite exist in the Illecillewaet district,—at Mount Stephen (Tunnel Mountain), and at Hot Springs and Hendryx Camp's, Kootanie Lake, etc., in the province of British Columbia. Fine specimens consisting of more or less perfect octahedra, the axes of some of which were five centimetres in length, have been found, in *vugs*, at the Silver Islet mine Lake Superior.

105. **GARNET**—Is very frequently met with, and in nearly all parts of the Dominion. The following comprise some of the many localities of its occurrence. In the province of Quebec: small beds of granular red garnet occur at St. Jérôme (Terrehonne Co.), in Rawdon (Montcalm Co.), and at the north-east side of Bay St. Paul (Charlevoix Co.): white lime-alumina garnet, mixed with serpentine, is met with at Orford, (Sherbrooke Co.), and an apparently homogeneous rock composed in great part of a similar variety, occurs at St. Francis (Beauce Co.): red and yellowish-red varieties are met with in the townships of Chatham and Grenville (Argenteuil Co.); a rose-red iron-alumina garnet is found disseminated in small masses through gneiss on the Rouge River and vicinity in the township of Clyde, and dark red garnet in the townships of Villeneuve and Templeton, and large and handsome crystals of colorless, light brownish, pale olive-green, and brownish-yellow garnet in the township of Wakefield, Ottawa county. Magnificent crystals of red garnet occur, imbedded in micaceous schist, on the Skeena and Stickeen rivers, and a massive brownish-red manganian lime-iron garnet is found near Foster's Bar, Fraser River—in the province of British Columbia. Analyses, T. S. Hunt, Geol. Can., 1863, 496. See further under "Almandite," "Andradite," "Chromiferous garnet," "Essonite," "Grossularite," "Spessartite."

106. **GENTHITE**—A mineral apparently identical with Genthite has been met with in a vein on Michipicoten Island, Lake Superior, province of Ontario. Analyses, T. S. Hunt, Geol. Can., 1863, pp. 506, 507.

107. **GIESECKITE**—Dysyntribite occurs at Arisaig pier and Frenchman's Barn in Antigonish county, province of Nova Scotia.

108. **GLAUCONITE**—Occurs in a sandstone of the Lauzon formation, near Point Lévis (Levis Co.), and on the Island of Orleans, in the province of Quebec. Analyses, T. S. Hunt, Geol. Can., 1863, p. 487.

109. **GRENILITE**—Has been found at Cape Blomidon (King's Co.), and Two Islands and Five Islands (Colchester Co.), in the province of Nova Scotia. Analyses, A. A. Hayes, Am. Journ. Sci., vol. xxv., p. 78, 1834; O. C. Marsh, ib., 2 ser., vol. xlv, p. 362, 1867; A. B. Howe, ib., 3 ser., vol. xii, p. 270, 1876.

110. **GOLD**—The most important auriferous regions of Canada are situated in the provinces of British Columbia, Quebec, and Nova Scotia; the first on the Pacific coast, the last forming the extreme eastern portion of the Dominion. Gold is, however, also found in some of the rivers of the North-West Territory—in the Lake of the Woods and Lake Superior region, and in the district north of Lake Ontario, in the province of Ontario,—and is reported to have been found in a few localities in the province of New Brunswick. In British Columbia mining has been almost entirely confined to the placer deposits. In the vicinity of the Lake of the Woods, and of Lake Superior, gold occurs in veins associated with silver and other ores. In the counties of Madoc and Marmora (province of Ontario), in auriferous misspickel. In the province of Quebec the placer deposits of the Chaudière region and of the township of Ditton are the only ones in which much work has as yet been attempted. The gold of Nova Scotia is found in quartz, the alluvial gold so far discovered being quite inconsiderable in quantity.

111. **GOTHITE**—Is mentioned by Dr. Harrington, as occurring, in association with black oxide of manganese and calcite, in veins cutting the Lower Carboniferous

limestone at Black Rock, near the mouth of the Shubenacadie, province of Nova Scotia.

112. **GRAPHITE**—This mineral is met with in most of the stratified rocks of the Laurentian system; not only the limestones, but the gneiss, pyroxenite, quartzite and pyrrholite beds sometimes hold disseminated graphite. It is also met with in the iron ores of the series, as in the township of Hull (Ottawa Co.), in the province of Quebec. Apart from its being met with in a disseminated form, it occurs in beds or seams from a few inches to two or three feet in thickness. These are often interrupted giving rise to lenticular masses, which are sometimes nearly pure and at other times mingled with carbonate of lime, pyroxene, and other foreign minerals. The most important deposits are in the townships of Buckingham and Lochaber (Ottawa Co.), and Grenville (Argenteuil Co.), province of Quebec; but it is also found in the townships of Burgess (Lanark Co.), Loughborough and Bedford (Frontenac Co.), province of Ontario, and, in small quantity, in other localities in these provinces. It is also met with, in a disseminated form, at French Vale and Glendale, in the province of Nova Scotia; in the vicinity of St. John, province of New Brunswick; and at Alkow Harbor, Dean's Canal, in the province of British Columbia. Localities and general mode of occurrence, T. S. Hunt, Geol. Can., 1863, pp. 529, 793, and Rep. Geol. Can., 1863-66, pp. 218-223. Analyses, etc., of Canadian Graphite, G. C. Hoffmann, Rep. Geol. Can., 1876-77, pp. 489-510: analyses of disseminated graphite from Nova Scotia and New Brunswick, G. C. Hoffmann, Rep. Geol. Can., 1878-79, p. 2; ib., 1879-80, p. 1 H.

113. **GROSSULARITE**—Handsome specimens of a white lime-alumina garnet are found in the township of Wakefield (Ottawa Co.), province of Quebec (G. F. Kunz, Analyses, C. Bullman, Am. Journ. Sci., 3 ser., vol. xxvii, p. 306, 1884). The white lime-alumina garnet from Orford (Sherbrooke Co., P. Que.), referred to under "Garnet," is also referable to this variety.

114. **GYPSEUM**—Occurs in connection with the Lower Carboniferous limestones in enormous deposits in the province of Nova Scotia. It is largely quarried at Windsor, Newport, Walton, Wentworth, Shubenacadie, and a number of other places. It is a very abundant mineral in the province of New Brunswick, the deposits being both numerous and extensive. They occur in all parts of the Lower Carboniferous district, in King's, Albert, Westmorland, and Victoria counties. Rock masses of granular and compact gypsum, more or less mixed with dolomite, characterise the Onondaga formation of western Ontario. They occur largely in the valley of the Grand River, more especially in the townships of Dumfries, Brantford, Oneida, Seneca, and Cayuga, etc.—It is also met with in the province of Manitoba. See also notes to "Alabaster," "Selenite."

115. **GYROLITE**—Is found on apophyllite in trap, about twenty-five miles south-west of Cape Blomidon, between Margareville and Port George, Annapolis county, province of Nova Scotia. Anal., H. How, Ed. N. Phil. Journ., new series, vol. xiv, p. 117, 1861.

116. **HALITE**—An important deposit of rock salt is known to exist along the eastern shore of Lake Huron, embracing the counties of Bruce, Huron and Lambton, in the province of Ontario. It was first met with at Goderich, in 1866, in a depth of 964 feet; in the year following at Clinton, at a depth of 1,180 feet, and in the succeeding year at Kincardine, at a depth of about 900 feet; subsequently at Seaforth at 1,035 feet, and again at Kingstone's Mills in Warwick, at 1,200 feet. A boring made in Goderich in 1876, and which was carried to a depth of 1,517 feet, has shown the existence of no less than six beds of rock salt, one of which is close upon 31 feet, and another very nearly 35 feet in thickness. For geological details, records of borings, and analyses of brines and salt, see following reports by Dr. T. Sterry Hunt—"On Brine-Springs and Salt," Rep. Geol. Can., 1863-66, pp. 263-272. "On the Goderich Salt Region," ib., 1866-69, and pp. 211-242, and a second report on the Goderich salt region, ib., 1876-77, pp. 221-243.

117. **HALOTRICHITE**—Has been found in some heaps of shale and slack coal, at the Glace Bay coal mines, in Cape Breton county, province of Nova Scotia. Anal., E. Gilpin, Trans. N. S. Inst., vol. vi, p. 175, 1883-86.

118. **HELIOTROPE**—Reported by Prof. How, as having been found by Dr. Gesner in small nodules or fragments of rock on the beach of Chute's Cove (Annapolis Co.), has been found, *in situ*, by Mr. C. W. Willmot, at Two Islands (Cumberland Co.), province of Nova Scotia.

119. **HEMATITE**—Important deposits of red hematite are met with at several localities in Pictou and other counties in Nova Scotia. It occurs, in association with specular iron ore, among the Huronian strata of the Quaco hills, and more abundantly in those of West Beach and Black River, St. Johns county, province of New Brunswick. Forms an extensive bed in the township of McNab (Renfrew Co.), and is further found in the townships of Dalhousie and Beckwith (Lanark Co.), Palmerston (Frontenac Co.), Madoc (Hastings Co.), Leeds (Leeds Co.), etc.—at Gros Cap, north side of Michipicoten Harbor, and other localities in the Lakes Superior and Huron

region, province of Ontario. See also notes to "Micaeous iron ore," "Specular iron ore," "Martite," Mineral associations of hematite, B. J. Harrington, Rep. Geol. Can., 1873-74, pag. 212. Analyses, by various analysts, ib., pp. 223-226, and subsequent Reports.

120. **HEULANDITE**—Fine specimens of this mineral are met with at Isle Haute, Partridge Island, and Two Islands [Cumberland Co.], also at Black Rock, Hall's Harbor, Long Point, and Cape Blomidan [King's Co.], in the province of Nova Scotia.

121. **HORNBLende**—Black crystallized hornblende enters abundantly into the diorites of Yamaska Mountain (Yamaska Co.), and Mount Johnson (Iberville Co.), and occurs sparingly in the trachytes of Brome (Brome Co.), and Shefford (Shefford Co.) Mountains: beds of black hornblende, holding garnets are associated with the serpentines of Mount Albert in the Shickshock Mountains (Gaspé Co.), and black or greenish hornblende is very commonly disseminated through the felspathic rocks of the Laurentian series, giving rise to syenite and syenitic gneiss: also forming beds of hornblende rock, as at Lake St. John (Chicoutimi Co.), Province of Quebec. Black or dark green hornblende, in cleavable masses, is found associated with the magnetite of Bathurst and South Sherbrooke townships (Lanark Co.), Province of Ontario. Anal., B. J. Harrington, Rep. Geol. Can., 1873-74, p. 201.

122. **HORNSTONE OR CHERT**—Occurs, in veins traversing syenite in the township of Grenville (Argenteuil Co.), in the Province of Quebec; in great abundance, in nodular masses and thin layers, in the Corniferous formation, and occasionally, in a similar form, in the limestones of the Trenton and Niagara groups; also, in layers, in the lower beds of the silver-bearing rocks of Thunder Bay (the lower division of the upper copper-bearing rocks of Logan), Lake Superior, Province of Ontario.

123. **HOWLITE**—Occurs, in the form of nodules which are generally about the size of filberts or pigeon's eggs, and occasionally, but rarely, as much as two inches in diameter, imbedded in anhydrite and gypsum at Brockville, and in gypsum at Winkworth, Newport Station, Noel, etc., in Hants county, Province of Nova Scotia. Analyses, H. How, Phil. Mag., 4 ser., vol. xxxv., p. 32, 1868.

124. **HUMBOLDTINE**—Has been observed as a sulphur-yellow incrustation upon the black schists at Kettle Point in the township of Bosanquet, Lambton County, Province of Ontario.

125. **HURONITE**—The Huronite of Dr. Thompson—an impure or altered form of anorthite—is found, *in situ*, near Sudbury (District of Nipissing, Province of Ontario), where it occurs in rounded or somewhat angular masses, in a dark green dyke of diabase. Anal., B. J. Harrington, Trans. Roy. Soc. Can., vol. iv., sec. iii., p. 82, 1886.

126. **HYACINTH**—Cherry-red, transparent crystals of zircon, are mentioned by Dr. Hunt as occurring in the crystalline limestone of the township of Grenville, Argenteuil County, Province of Quebec.

127. **HYALITE**—Good specimens of this mineral were obtained by Mr. J. McEvoy from cavities in a dark grey foliated basalt occurring near Hih-hum Lake, South of Loon Lake, British Columbia.

128. **HYPERSTHENE**—Occurs, in broad lamellar masses, with andesite and ilmenite, constituting a rock, at Chateau Richer (Montmorency Co.), and in the parish of St. Urbain near Bay St. Paul, Charlevoix Co., in the Province of Quebec, also Paulit at Paul Island, Nain, coast of Labrador. Anal., T. S. Hunt, Geol. Can., 1863, p. 468.

129. **ICELAND-SPAR**—Fine cleavable and transparent masses of calcite occur at Harrison's location on St. Ignace Island, Lake Superior, and in the township of Galway (Peterborough Co.), Province of Ontario.

130. **ILMENITE**—Occurs in vast beds or masses in anorthosite rock in the parish of St. Urbain, at Bay St. Paul (Charlevoix Co.), and in a similar rock in Chateau Richer (Montmorency Co.), and in Rawdon (Montcalm Co.) Large deposits, associated with labradorite rocks, have also been observed near the mouth of Rapid River (Bay of Seven Islands), on the Saguenay River, on the shores of Lake Kenogami, and it has also been met with in several other localities in the Province of Quebec. Analyses, T. S. Hunt, Geol. Can., 1863, p. 501, and Rep. Geol. Can., 1866-69, p. 260.

131. **ILVAITE**—A substance which, from its composition and physical characters, was regarded as a variety of lievrite, was found in the form of a boulder, in the vicinity of Ottawa (formerly Bytown), Carleton County, Province of Ontario. Description and analysis, T. S. Hunt, Geol. Can., 1863, p. 465.

132. **INFUSORIAL EARTH**—Is found occupying the bottoms of lakes in several of the counties of the Maritime Provinces. The deposits are not unfrequently of considerable depth, and the earth remarkably pure. Some of the more important localities are—Fountain Lake, Amherst (Cumberland Co.), Folly Lake (Colchester Co.), and Merigonish (Pictou Co.), in the Province of Nova Scotia, and Fitzgerald Lake, about seven or eight miles from St. John (St. John Co.), Pollet

Lake, Mechanic Settlement, and Pleasant Lake, about six miles to the south-west (King's Co.), in the Province of New Brunswick. Anal., G. C. Hoffman, Rep. Geol. Can., 1878-79, p. 4 h.

133. **IRIDOSMINE**—Occurs, as first observed by Dr. T. S. Hunt, in the form of small hard steel-grey plates, associated with the native platinum found in the gold washings of the Rivière du Loup, Beauce County, Province of Quebec.

134. **IRON-ochre**—Extensive deposits of iron-ochre (*var.* limonite) are met with in numerous localities in the Province of Quebec. A remarkable deposit of this material is found in St. Anne (Montmorency Co.), and very large beds of the same occur in Cap de la Madeleine (Champlain Co.), and in Pointe du Lac (St. Maurice Co.). Amongst other places, where deposits of more or less importance occur, may be mentioned the Counties of Bonaventure, Joliette, Laval and Vaudeuil. In the Province of Ontario, beds of ochre are met with in Walsingham (Norfolk Co.), Esqueving (Halton Co.), Sydenham (Grey Co.), Nottawasaga (Simcoe Co.), and other townships. Chemical examination of iron-ochres, T. S. Hunt. Geol. Can., 1863, p. 512.

(To be Continued.)



NOTICE

Re ONTARIO CROWN LANDS.

CROWN LANDS DEPARTMENT,
TORONTO, Nov. 29th, 1890.

NOTICE IS HEREBY GIVEN that the lands lying between the east limit of the Township of Awrey, in the District of Nipissing, produced north and south, and the west limit of the Townships of Esten and Spragge, in the District of Algoma, produced north, are withdrawn from sale or location from, and including the first day of December, now next, and no further sales or locations will be made of lands within said limits until further notice, except in cases:—

1. Where application has been duly made and the purchase money has heretofore been paid into the Department; or

2. Where application has been made and a large proportion of the purchase money has heretofore been paid, and where a substantial expenditure of money has been heretofore made in developing or in completing a survey of the location.

No application heretofore made unaccompanied by the purchase money for lands in the said limits except as aforesaid, will be considered.

ARTHUR S. HARDY,

Com. Crown Lands.



SEALED TENDERS addressed to the undersigned, and endorsed "Tender for Caïsson," will be received at this office until Friday, the 5th day of December next, inclusively, for supplying, erecting and completing in place, a Wrought Iron Caïsson for the Dry Dock now in course of construction at Kingston, Ont., in accordance with the plan on exhibition at this office, and at the Engineer's office, 30 Union Street, Kingston, and with the conditions and stipulations contained in a Form of Tender, copies of which can be obtained on application to the undersigned, and W. O. Strong, Esq., Resident Engineer, 30 Union Street, Kingston, Ont.

Tenders will not be considered unless made on form supplied, and signed with the actual signatures of tenders.

An accepted bank cheque payable to the order of the Minister of Public Works, equal to five percent. of amount of tender, must accompany each tender. This cheque will be forfeited if the party decline the contract or fail to complete the work contracted for, and will be returned in case of non-acceptance of tender.

The Department does not bind itself to accept the lowest or any tender.

By order,

A. GOBEIL,
Secretary.

Department of Public Works,
Ottawa, 19th Nov., 1890.


GEO. A. SPOTSWOOD, C.E., Mining Engineer,

KINGSTON, - - - ONTARIO, CAN

Mines and Mineral Properties Examined
and Reported on or Negotiated.
Explorations and Exploitations Conducted.

SPECIALTIES:

IRON, NICKEL AND PHOSPHATE.



Dr. FRANCIS WYATT.


SPECIALTIES:

Sulphuric Acid, Pyrites,

And PHOSPHATES.

24 PARK PLACE,

NEW YORK.





ST. LAWRENCE CANALS.

RAPIDE PLAT DIVISION

NOTICE TO CONTRACTORS.

SEALED TENDERS addressed to the undersigned and endorsed, "Tender for the St. Lawrence Canals," will be received at this office, until the arrival of the eastern and western mails on Wednesday, the 3rd day of December next, for the construction of a lift lock, weirs, etc., at Morrisburg, and the deepening and enlargement of the Rapide Plat Canal. The work will be divided into three sections, each about a mile in length.

A map of the locality, together with plans and specifications of the respective works, can be seen on and after Wednesday, the 19th day of November next, at this office, and at the Resident Engineer's office, Morrisburg, where printed forms of tender can be obtained.

In the case of firms there must be attached to the tender, the actual signatures of the full name, the nature of the occupation and residence of each member of the same, and, further, an accepted cheque on a chartered bank in Canada for the sum of \$6,000, must accompany the tender for Section No. 1, and an accepted cheque on a chartered bank in Canada, for the sum of \$2,000 for each of the other sections.

The respective accepted cheques must be endorsed over to the Minister of Railways and Canals, and will be forfeited if the party tendering declines entering into contract for the works at the rates and on the terms stated in the offer submitted. The cheques thus sent in will be returned to the respective parties whose tenders are not accepted.

This Department does not, however, bind itself to accept the lowest or any tender.

By order,

A. P. BRADLEY,
Secretary,

Department of Railways and Canals,
Ottawa, 7th November, 1890.



Money Orders.

MONEY ORDERS may be obtained at any Money Order Office in Canada, payable in the Dominion and Newfoundland; also in the United States, the United Kingdom, France, Germany, Austria, Hungary, Italy, Belgium Switzerland, Portugal, Sweden, Norway, Denmark, the Netherlands, India, Japan, the Australian Colonies, and other countries and British Colonies generally.

On Money Orders payable within Canada the commission is as follows:

If not exceeding \$4	2c.
Over \$4, not exceeding \$10	5c.
" 10, " " 20	10c.
" 20, " " 40	20c.
" 40, " " 60	30c.
" 60, " " 80	40c.
" 80, " " 100	50c.

On Money Orders payable abroad the commission is:

If not exceeding \$10	10c.
Over \$10, not exceeding \$20	20c.
" 20, " " 30	30c.
" 30, " " 40	40c.
" 40, " " 50	50c.

For further information see OFFICIAL POSTAL GUIDE.

Post Office Department, Ottawa,
1st November 1889.



North-West Mounted Police.

RECRUITS.

APPPLICANTS must be between the ages of Twenty-two and Forty, active, able-bodied men of thoroughly sound constitution, and must produce certificates of exemplary character and sobriety.

They must understand the care and management of horses, and be able to ride well.

The minimum height is 5 feet 8 inches, the minimum chest measurement 35 inches, and the maximum weight 175 pounds.

The term of engagement is five years.

The rates of pay are as follows:—

Staff-Sergeants \$1.00 to \$1.50 per day
Other Non-Com. Officers.. 85c. to 1.00 "

	Service pay.	Good conduct pay.	Total.
1st year's service,	50c.	—	50c. per day
2nd "	50	5c.	55 "
3rd "	50	10	60 "
4th "	50	15	65 "
5th "	50	20	70 "

Extra pay is allowed to a limited number of blacksmiths, carpenters and other artisans.

Members of the force are supplied with free rations, a free kit on joining and periodical issues during the term of service.

Applicants may be engaged at the Immigration office, Winnipeg, Manitoba; or at the Headquarters of the Force, Regina, N.W.T.

C. P. Willimott & Co.

Mineralogists and Lapidaries

333 WELLINGTON ST., OTTAWA.

Every variety of stone cut and polished on the most reasonable terms.

Cut stones of every description always on hand.

Thin sections of rocks for microscopical examination carefully prepared.

Collections of named characteristic minerals arranged in neat divided boxes, from \$1.00 upwards. These collections are in use at McGill and Toronto Universities, which fact alone should recommend them.

Tourists and others visiting the city should not fail to give us a call.

Parties living in mineral localities should correspond with us if they have any minerals for sale or exchange.

SEND FOR CATALOGUE.

WE WILL BUY, SELL OR EXCHANGE.

Standard Powder Company



MANUFACTURERS OF ALL KINDS OF

GLYCERINE EXPLOSIVES

—FOR—

MINING

—AND—

RAILROAD WORK.

ADDRESS—

W. H. HARRISON,

MANAGER,

BROCKVILLE, ONT.

LEDoux & COMPANY,

10 CEDAR ST., NEW YORK,

Engineers, Metallurgists &
Assayers.

Public Ore Sampling & Storage Works

All the principal buyers of furnace materials in the world purchase and pay cash against our certificates of assay, through New York banks.

By special permission of the Secretary of the Treasury of the United States, cars of ore or copper matte passing through in bond can be opened and sampled at our works.

Consignments received and sold to highest bidder. Send for circular giving full particulars.

Mines examined and sampled. Assays and Analyses of all kinds.

HARRIS & CAMPBELL

Latest Designs in Drawingroom, Diningroom
and Bedroom

FURNITURE

With improved Steam Machinery our facilities for manufacturing Cabinet Goods are complete. Our upholstery Department is well stocked with latest imported patterns.

Corner QUEEN & O'CONNOR Sts.
OTTAWA.

SOCIÉTÉ

Canadienne d'étude Minières

CAPITAL, - - \$100,000

Assaying, Prospecting and Mining.

HEAD OFFICE, - - - 30 St. FRANCOIS XAVIER ST
P. O. Box 1625, MONTREAL.

Office in Paris (France) 12 Place Vendome.

DIRECTORATE:

M. SCHWOB, Vice-Consul of France, President
JOHN S. HALL, Q.C., M.P.P., Vice-President.
C. A. DUGAS, Judge of Sessions }
C. H. A. GRANT, Directors.
C. DUQUET, Alderman, Quebec, }
G. WERNER, Secretary and Treasurer.
L. DE LA VALLEE POUSSIN, I.C.P. }
JOHN D. FROSSARD, M.E. } Consulting Engineers.
JOHN S. HALL, Q.C., M.P.P., Advocate, Legal Adviser of the E.

CANADA ATLANTIC RAILWAY.

THE SHORTEST PASSENGER ROUTE BETWEEN

Ottawa & Montreal

AND ALL POINTS EAST & SOUTH.

The only road in Canada running trains lighted with electricity and heated by steam from the engine. Luxurious Buffet Pullman Palace Cars on all trains between Ottawa and Montreal. Only line running through Sleeping Cars between

Ottawa, Boston and New York

And all New England and New York points.

Baggage checked to all points and passed by Customs in transit. For Tickets, Time Tables and information apply to nearest agent or to S. EBBS, City Passenger Agent,

GEO. H. PHILLIPS, Gen. Agent, 24 Sparks St., OTTAWA.
VALLEYFIELD.

A. E. CAIRNS, General Agent, 136 St. James St., MONTREAL

Or at 260 Washington St., Boston, and
317 Broadway, New York.

E. J. CHAMBERLAIN, General Manager, General Offices, Ottawa.
C. J. SMITH, General Passenger Agent.

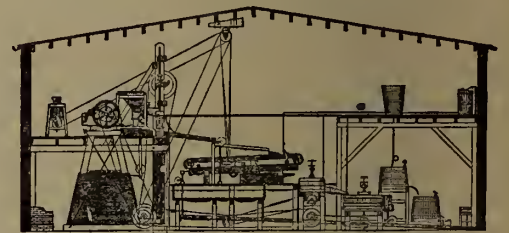
Charles M. Rolker,

— LESSEE, —

New York Ore Milling & Testing

WORKS.

Office, - - 18 Broadway, New York.



Cable Address:—PHAFTRY, New York.

Consulting Mining Engineer.

Examinations made and reports rendered of mines and mining property, metallurgical works and processes.

Ores can be practically tested by any known process and the necessary plan of reduction determined. Works are complete in every respect for practical testing of Gold, Silver and Concentrating Ores and Tailings. ANALYSIS of ores and furnace products, etc.

BELL TELEPHONE CO.

OF CANADA.

ANDREW ROBERTSON, PRESIDENT
C. F. SISE, VICE-PRESIDENT
C. P. SCLATER, SECRETARY-TREASURER

HEAD OFFICE, - MONTREAL.

H. C. BAKER, Manager Ontario Department
HAMILTON.

This Company will sell its instruments at prices ranging from \$10 to \$25 per set. These instruments are under the protection of the Company's patents, and purchasers are therefore entirely free from risk of litigation.

This Company will arrange to connect places not having telegraphic facilities with the nearest telegraph office, or it will build private lines for firms or individuals, connecting their places of business or residences. It is also prepared to manufacture all kinds of electrical apparatus.

Full particulars can be obtained at the Company's offices as above, or at St. John, N.B., Halifax, N.S., Winnipeg, Man., Victoria, B.C.

The Canadian Mining Review

CONDUCTED BY E. T. A. BELL

OFFICES:

UNION CHAMBERS, 14 METCALFE ST.,
OTTAWA.

Vol. IX. DECEMBER, 1890. No. 12

PUBLISHED ON THE 25th OF EACH MONTH.

SUBSCRIPTION RATES.

ONE YEAR (in advance) \$2.00
 SIX MONTHS..... 1.00
 SINGLE COPY..... .15
 BRITISH AND EUROPEAN (post paid)..... 2.00

ADVERTISING RATES.

SPACE.	ONE MONTH.	THREE MONTHS.	SIX MONTHS.	TWELVE MONTHS.
One Page.....	\$30.00	\$70.00	\$130.00	\$250.00
One-Half Page...	20.00	40.00	70.00	130.00
One-quarter Page..	10.00	25.00	40.00	75.00
One-Eighth Page..	8.00	15.00	25.00	40.00

Professional and Business Cards.

Advertisements under this head inserted at the rate of \$15.00 per year per inch.

Want Column.

Fifteen cents per line; no advertisement to occupy less than two lines. Orders for this column, and for all transient advertisements, must be accompanied by cash.

Remittances.

Remittances should always be made by Bank Drafts, Cheques or Post Office Orders, made payable to the Manager. American Postage Stamps are of no use to us whatever, and will not be accepted in payment of small amounts.

Operation Invited.

The publishers earnestly request the co-operation of readers of the REVIEW for information, communications that can be utilized, suggestions, news items, etc., etc. All such should be addressed to the Editor.

Ontario's Nickel and Copper Ores.

One of the events of the month in mining affairs was the visit of the Toronto Board of Trade to the Sudbury district. Much as has been written on the great deposits of nickel and copper ore in the region north of Georgian Bay, there are few persons who have a right conception of the progress already made in raising and smelting the ore. The view of the President of the Toronto Board of Trade, and which he was frank enough, at the close of the visit, to confess having held, is no doubt that of most people in Canada, viz: that speculative holes were being sunk upon veins in the hope of starting a boom to sell locations. But Mr. Davidson knows that steel is believing, and he has no doubt now that there are immense bodies of valuable ore in the Sudbury country, and that mining enterprise as carried on there is substantial and permanent. The thirty or forty solid and sober business men of Toronto will be able to tell their fellow-citizens and the people of Ontario generally, that all reports heretofore published have been in no respect extravagant. One of the most careful of their number, Mr. Robert Jaffray, was impelled to say, as the Queen of Sheba said after seeing for herself the glory of Solomon, that the half had not been told them. He might have said much more within the limits of moderation, and had

an open and positive confession been made of the injustice done to newspaper and other reports upon the Sudbury mines it might have done the souls of the doubting Thomases of the party some good. The justification is tardy, but we rejoice in its having been made at last, and we earnestly trust that the Toronto capitalists will proceed to show their faith by their works. The authoritative statement of the experts sent by the Government of the United States to report upon the supply of ore, leaves no room to doubt that the quantity is enormous. "There are 650,000,000 tons of ore in sight," those experts stated after having carefully explored the five mines in the vicinity of Sudbury, and the great ranges discovered in Creighton, Denison and Graham. Here is enough to last for eighty years, were mining to be carried on annually at the highest rate yet reached in all the iron mines of Michigan, Wisconsin and Minnesota. But how much greater the quantity is we can only determine when the depth of the ore is ascertained and all the ranges of the district are discovered. Multiply the Washington experts' estimate of ore in sight by one thousand, and we are probably within the mark. Let us be modest, however, and see what the estimate of ore in sight implies. The nickel contents, computed at an average rate of two and a half per cent., would be 16,750,000 tons, or 33,500,000,000 pounds. At fifty cents per pound, which is about the present price of refined nickel the product would represent the enormous value of \$16,750,000,000, and even if the price fell to ten cents per pound it would represent \$3,350,000,000, or more than enough to pay off the public debt of the Dominion of Canada twelve times over! The copper contents computed at 5 per cent., would be 67,000,000,000 pounds, which at ten cents per pound (the current rate is 15 to 16) would equal \$6,700,000,000. These figures are so large that we can scarcely realize them, but they will at all events serve to demonstrate the value of the industry which was started only four years ago at Sudbury. Recent experiments with alloys of iron and steel have made clear the fact that Ontario is wondrously rich in her mineral possessions, and if a proper spirit of enterprise is exhibited, she may look forward with confidence to the occupying of a foremost place among the countries of the earth in the production of economic metals. She has great supplies of rich iron ores as well as ores of nickel, and it will be the fault of her own people if she does not become the seat of the world's nickel-steel industry. The members the Toronto Board of Trade know the possibilities before them. Their visit to Sudbury has given them an education such as few others have had an opportunity to acquire, and we shall be disappointed in their pluck and enterprise if they do not turn what they know to a useful and practical account. It

ought not to be difficult in a city of the size and importance of Toronto to organize a company with a capital of \$1,000,000 to refine the matte produced at the Sudbury furnaces, open up one or more of the great iron ranges in Hastings, Peterborough or Haliburton, put up one smelting furnace and a steel converter of good capacity, and carry on the manufacture of nickel steel. They possess rare opportunities, and they cannot begin too early to take advantage of them.

The Mining Tax.

The following are the resolutions, affecting proposed taxation of mines, to be submitted by the Hon. Mr. Mercier's Government, during present sitting of Quebec Legislature:—

Resolved, 1.—That from the first day of May, 1891, a royalty shall be levied in favour of the Crown upon every mine which is now or may hereafter be sold, conceded or otherwise alienated. That such royalty shall, unless otherwise determined by letters patent already granted, consist of a percentage of three per cent. of the merchantable value of the products of all mines and minerals, upon the following:—

Iron, including iron pyrites, and chromic and titanite iron ores, copper, nickel and cobalt, manganese, antimony, lead, zinc, aluminium, molybdenum, baryta, silver, gold, including alluvial gold, mercury, tin, asbestos, phosphate of lime, graphyte, mica, coal, petroleum, ochre, soap stone. On gold, $2\frac{1}{2}$ per cent. of the gross weight, estimated at \$18.00 per ounce, and on silver at $2\frac{1}{2}$ per cent. of the gross weight.

Resolved, 2.—That the Lieutenant-Governor in Council may appoint the officers he deems necessary for the carrying out of the law, to be based upon the resolutions, and fix their rank and salaries.

Resolved, 3.—That any person, firm or company may obtain from the Commissioner of Crown Lands an exploration permit, with the right to make all necessary works to establish the mining value of any land; which permit is valid for three months.

Resolved, 4.—That the holder of such permit may afterwards obtain the sale of the mine by paying the price mentioned in the law to be based upon the resolutions, and by complying therewith as well with the regulations passed thereunder; the whole subject, however, to the right of preference allowed to the proprietor of the surface, to the exclusion of any other, to acquire the mines and minerals found, or that may be afterwards found under the surface of his property.

Resolved, 5.—That the application for such permit shall contain as exact a description as possible of land required to the satisfaction of the Commissioner, and shall be accompanied by the following fees, as the case may be:—

1. If the mine is upon private lands, five dollars for every fifty acres.

2. If the mine is upon Crown Lands, ten dollars for every fifty acres.

Resolved, 6.—That any person may obtain from the Commissioner the sale of one or more mining concessions upon the following conditions:—

1. Upon private lands, after the owners thereof have been placed *in mora* to take a deed of sale thereof; if they refuse to avail themselves of such right; the whole in conformity with the law to be based upon these resolutions.

2. Upon public lands, by complying with the provisions of the said law.

Resolved, 7.—That a mining concession shall comprise a minimum superficies of fifty acres and a maximum of one hundred acres.

That the direction of the exterior lines of mining concessions shall be determined by the Commissioner.

Resolved, 8.—That the costs of survey and setting of bounds, as well as of setting up the posts under the law to be based upon these resolutions, are payable by the applicant.

Resolved, 9.—That every post which is destroyed or removed shall be replaced at the expense of the owner, within one month; and the proceedings to have it replaced shall be the same as for the original placing of boundaries.

Resolved, 10.—That, if need be, the owner shall pay to the owner of the surface the damages that may be caused by the taking possession and the opening and working of the mine.

Resolved, 11.—That every owner of a mining conces-

sion who neglects to again set up the posts or to replace those which have been removed or destroyed, as required by the law to be based upon these resolutions, shall be liable to a fine not exceeding twenty-five dollars for each post which he neglects to set up or replace.

Resolved, 12.—That every person who wilfully destroys, damages, breaks or removes such posts shall be liable to a fine not exceeding one hundred dollars for each offence.

At last the Quebec Government has shown its hand, and the foreshadowings of the speech from the throne have materialized in a proposal to levy a royalty of three per cent. upon the merchantable value of the products of all mines and minerals. Assurances had been privately given members of the Legislature that it was only contemplated to introduce a system of leasing lands upon royalty, that no tax would be placed upon mines already sold. We were disposed to credit this; for we entertained the opinion expressed by Mr. W. H. Nichols, of New York, at the meeting of mine owners in St. Lawrence Hall, that it was incredible that any civilized government, in this age of the world, could place a discouraging burden upon mining industries. We have repeatedly expressed approval of the idea of granting leases upon royalty subject to compulsion of working; but as far as we can see in the proposed resolutions there is no requirement of productive effort. This we presume would be provided for, as it is hardly to be supposed that a phosphate lot of 200 acres now held by the Crown at the price of \$1,000, is to be sold for \$40, without obligation of working. If so, speculators would speedily tie up the whole country, and all the present evils of an unproductive monopoly would be intensified. But our objections are directed against the proposal to tax the product of mines that have been sold outright, and have been fitted up, operated by the purchasers with confidence in the good faith of the Government, and the belief that a sale was a sale. Apart from this breach of contract, which we stigmatize as a downright act of dishonesty, we declare that the mining industries of this Province are not in so prosperous a condition as to be able to bear the burden of a direct tax. If the proposal meant a tax upon profits it would be a different thing, and prosperous mines could afford to pay it; but mining is the most speculative of all industries, and a tax upon output would often be an additional loss to a losing enterprise. If any branch of industry is to be singled out to bear the strain of Quebec finance, let it be one that receives Government favors and enriches itself by legal aid. The sugar refineries are favored by the Dominion Government with a protection against foreign competition to the extent of 2 to 3 cents per pound. If the Quebec Government demanded one cent a pound out of this benefit, there would be some reason in it, but instead of levying upon protected and favored industries, the attack is made upon the one unprotected and unfavoured industry of Canada, which in addition to the burden of its own natural difficulties, is saddled with the restrictions made to benefit pampered and petted pursuits, by

which the cost of all its supplies is increased and, if it is true, that protection raises wages, the cost of its labor is enlarged.

We denounce this piratical attack upon a struggling industry as a violation of honesty and propriety, and we warn the Quebec Government that our mining men represent an amount of influence and determination that it is dangerous to trifle with. Their manliness is shown by the fact that they have not gone whining for Government bonuses and protection, but have been content to take their chance in a fair struggle with nature's conditions, and this same characteristic will make them resist oppression by every resource within their power.

The Phosphate Season of 1890.

The close of navigation on the St. Lawrence brings the day of reckoning for all those industries whose products seek their markets beyond the sea. Perhaps no other industry in Canada is so dependent upon ocean freight as is phosphate mining. Of home market it practically has none; and its small trade with the United States consists entirely of low grade ore. All the high grade output and the great bulk of the whole production, is sold across the Atlantic, the chief portion to the United Kingdom, considerable to Germany, and a little to Holland and Sweden. The total exports, as per official returns furnished us by the shipping agents and Customs manifests have been:—

Lomer, Rohr & Co.:

To Europe	11,338
" United States	252

Tons..... 11,590

Millar & Co.:

To Europe	5,915
" United States	1,207½
" Canada	185

Tons..... 7,307½

Wilson & Green:

To Europe	5,688
" United States	263¾

Tons..... 5,951¾

Irwin, Hopper & Co.:

To Europe	938
-----------------	-----

Tons..... 938

Anglo-Canadian Co.:

.....	275
Tons.....	275
	26,062¼

Or a total export to all points of 26,062¼ tons; as compared with 29,987 tons during the same period last year. The distribution of these exports has been as follows:—

To Liverpool	12,647	To Newcastle....	200
" London	5,239	" Swansea	130
" Glasgow	1,752	" Queenstown ..	84
" Hull	820	" Bristol	60
" Hamburg	2,800	" United States..	1,723¼
" Grimsby	422	" Canada	185

The decrease is due partly to the lessened production of some mines, but chiefly, as we have already pointed out, to the fact that owners of phosphate lands have maintained a selling attitude instead of adopting a working policy.

As nearly all the expectations of making fortunes by land sales have been disappointed, it is to be hoped that the proprietors will now try to secure for themselves the abundant wealth that they have confidently expected to dispose of to others.

The year has been a most favorable one for the business; given the phosphate and all else has been smooth sailing. It has not had to go begging for a purchaser, vessels have been ready and eager to take it, and facilities for rail and water transport from the mines to Montreal and the methods of handling it there have been better than ever before.

Ocean freights have varied from 8s. 9d. down to nothing when some tramp, going to an outside port, was in need of ballast; but the bulk of the shipments paid from 6s. to 8s. 6d. A larger supply of cheap tonnage would have been available had not the deal freights flattened out in the summer to so low a rate that vessels turned away from the St. Lawrence to seek more lucrative business, and therefore the demand for phosphate as ballast under the deal cargoes was lessened.

Prices have been very satisfactory for the higher grades; 1s. 4d. for 80 per cent., with one-fifth penny per unit rise has been obtainable in London, and 1s. 5d. in Hamburg. The London price for 85 per cent. phosphate was therefore 1s. 5d. per unit, equal to about \$26 per ton in Montreal. A few choice lots have gained this handsome figure, but the bulk of the shipment have averaged much lower and there has been a reduction of price for the lower grades amounting to double the usual sliding scale, so that prices for 75 per cent. have been 1s. 1d. to 1s. 2d. and for 70% 11d. to 1s. per unit. At the latter price a ton of 70 per cent. phosphate in Montreal would realize only a little over \$13, or about one half of the value of 85 per cent. phosphate. Here is where the profits lie, and happy is he who strikes a bunch of the pure green rock, as did one of our operators in November, and from the labor of fifteen men made a clean profit in four weeks of \$1,500. The reduced price of the lower grades is due to the large supply of Carolina and Florida phosphates which analyze from 55 to 60 per cent. In the rivers of Florida beds of this material have been discovered, which can be raised by suction and pumped into boxes at trifling expense. On the lands of this State also great deposits of phosphate rock have been found, which were said to be of the highest quality and sufficient in quantity to supply the demand of the world. A Florida boom thereupon arose, which drowned out of sight our little Canadian boom; companies were floated and fortunes were made in land sales. Perhaps some day phosphate of higher grade will be produced in such quantities as to depress the price of the Canadian article, but at present the impression prevails that the deposits are less persistent and the quality more uncertain than the boomers have represented. There has cer-

tainly been a depressing effect from this source upon low grade phosphate and Canadian 60 per cent. which sold in the Spring at 10d. could not find a buyer in the fall at 7¼d.; and yet the price of higher grade keeps up and sales have been made for next year at 1s. 3d. for 80 per cent., 5,000 tons being said to have been placed at this rate by the representatives of the new General Phosphate Corporation.

The advent of this company into the field has been the chief feature of the year. They have made judicious selection of good lands in the Lievres River district, and have shrewdly made their payments to depend partly upon the output. All who are interested in the growth of this industry will heartily wish success to this enterprise. The visit of Mr. Hutchinson, of the Anglo-Continental Guano Works, of Hamburg and London, last year, resulted in the purchase of the Squaw Hill and Aetna Mines adjoining the Emerald Mine, and effective work is now in progress there. Mr. Hutchinson's paper, reproduced in our last issue, is unquestionably the most accurate description of the phosphate industry that has ever been given by a visitor and shows a remarkable mind that could grasp the salient features of a mining industry in so brief a survey. Among other new undertakings are those promoted by one of our most enterprising phosphate operators, Mr. Adolphe Lomer, of Montreal, who, in addition to the Foxton mine, has organized work upon an adjoining property, and has formed companies to operate upon the Blackburn and the MacLaurin properties, besides doing some work upon other leased lands. An ingenious method has been put into practice by this gentleman in his grinding mill at Buckingham for the mechanical separation of the impurities from the phosphate, which will tend largely to increase the profits of mining.

Some alarm has been caused by the intimation that the Quebec Government would seek to raise its revenue by imposing a tax upon minerals. Indignation meetings have been held by the mine owners at Sherbrooke and Montreal, and the excitement aroused may bear good fruit, not only in combating the imposition of any burdensome tax, but also in inducing the miners of the Province of Quebec to unite in forming an association, which shall be ready to take action upon any threatened legislation detrimental to this industry, and shall also afford means for mutual communication and instruction. In this latter aspect such associations of special industries prove most valuable, and we have had illustrations of the practical benefits of these societies in the production of such papers as the one just referred to, written by Mr. Hutchinson, and that presented previously by Mr. Hermann Voss, to which was due a great deal of the interest that was directed last year to Canadian phosphate.

One notable feature of the situation is a disposition to reduce the capitalization of com-

panies and the valuation of lands. It is proved that from well selected lands under good management, profitable returns may be secured from phosphate mining, but it is also perceived that the great prizes incident to gold and silver mining are not characteristic of the phosphate industry, and that it is desirable to keep nominal values low enough to permit of profits to show a fair percentage upon the investment. This healthful indication augurs well for future success, and with the assurance of a good and ever increasing demand for high grade phosphate, we may confidently predict the continued growth and prosperity of the Canadian phosphate industry.

A Wholesome Reminder.

Ontario papers have been making much ado lately over an announcement that Mr. T. A. Edison had made heavy investments in Canadian nickel lands. Here is the truth tersely stated by Mr. Edison's private secretary: "Mr. Edison has read your letter of 12th inst., and in reply thereto has instructed me to say that he is *doing nothing* at the present time in the Sudbury district and *will not, until owners* of property in that neighborhood *come to their senses.*" The italics, which are ours, furnish good food for reflection to our speculator friends. Shrewd business men of the calibre of the great inventor are quick to forsee a good field for judicious investment in our nickel deposits; but they are not to be deceived by wild-cat schemes or schemers; nor are they prepared to accept their ridiculous notions of the value, of what are often "mere prospect holes," entirely unproved and in many cases worthless. The sooner these over-sanguine individuals rid themselves of their chimerical ideas and get down to more rational figures, the better for themselves and the development of the country.

The Tariff on Mining Machinery.

The following Order-in-Council, under date of 28th ult., should simplify entries of mining machinery not manufactured in Canada, and it is hoped will obviate entirely the tedious and vexatious delays that have been characteristic of recent interpretations of the meaning of the Act:—

"His Excellency, under the authority of Section 252 of the Customs Act, and by and with the advice of the Queen's Privy Council for Canada, is pleased to order that there be required, in addition to such other evidence in each case as may be deemed necessary by the Minister of Customs, a special oath to be subscribed to by the importer before a Collector or other proper officer of Customs, whenever any free entry is rendered of Mining Machinery under item 291 of Section 11 of the Act 53 Vic., Chap. 20, such oath to be in the following terms:—

"I,, the undersigned importer of the machinery mentioned in this entry, do solemnly swear that it is Mining Machinery within the true meaning of the word, and that at the time of its importation was of a class and kind not manufactured in Canada, and that it is imported for use in mining only, at the mine, situated in the Province of and will be used for no other purpose whatever"

Sudbury Mineral Lands Withdrawn from Sale.

The Commissioner of Crown Lands for the Province of Ontario has taken the important step of withdrawing from sale and location, until further notice, all lands lying within what is generally known as the nickel bearing district of the Province. The official notice defines the territory thus withdrawn as lying between the east limit of the Township of Awrey, in the district of Nipissing, produced north and south, and the west limit of the Townships of Esten and Spragge, likewise produced. Upon referring to the map it will be observed that the former of these townships lies south and east of Lake Wahnapiatae, and the latter some fifteen or twenty miles west of the mouth of the Spanish river. The total width of the territory is about one hundred miles, and it extends from Georgian Bay and French river, on the south, to James' Bay on the north, embracing the valleys of the Spanish, Wahnapiatae and Moose rivers. There is no further intimation of the policy of the Government than the statement that the lands lying within the prescribed limits are withdrawn from sale or location "until further notice;" but it may be presumed that a policy will be determined upon and authorized before the close of the next session of the Legislature. The reasons which have influenced the Commissioner have not been divulged, but they are obvious enough to any person who knows the workings of the boom in the Sudbury district during the past year or two. Many locations have been taken up over that territory, for the most part by speculators, and since the action of the United States Congress in appropriating \$1,000,000 for the purchase of nickel, to be used in the manufacture of armor plates, there has been a great rush of prospectors, miners and speculators to secure locations. No doubt the Commissioner thought a time had come in the interest of the people, as well as of the Government of Ontario, to call a halt in the disposal of valuable public lands, and no doubt also that the future policy will be dictated by a greater regard for the public interests than was obtainable under the old one. To secure a larger revenue will naturally be one of his aims, while another should be the furtherance of active mining operations. If nickel realises the hope of some of the best practical metallurgists of America and Europe, it is almost certain that great activity will characterize mining enterprise in the Sudbury country henceforward; but the Commissioner will fail in his duty as well as of his opportunity if he neglect to make provision against the locking up of any portion of the mining territory by speculators, to be held for their exclusive benefit. The public interest should be the great consideration, and the best policy is that which will produce the greatest good for the benefit of the greatest number. We hope to have an opportunity of dealing with this subject at greater

length before the Government has settled down to what they are going to do about it.

A Mining Association for Quebec.

As the outcome of the miners' meeting held in Montreal last month, a circular has been issued and liberally distributed among the mining community calling attention to the proposition to establish a general mining association for the Province of Quebec. This is an important step, and if the proposal is carried into effect—and there is no good reason why it should not be—it will unquestionably result in great good. Experience has shown that united action is absolutely necessary in Quebec in order to counteract measures, which, if carried into effect, are calculated to do serious injury to its mining interests. Apart, however, from public questions, such an association would confer an immense boon in the propagation of knowledge respecting the true state of our mineral resources, in the interchange of ideas by wholesome discussion on subjects alike of interest to the owner and the operator, and in smoothing over these petty professional jealousies which unfortunately are sometimes too noticeable among a few of our mining men.

LETTERS TO THE EDITOR.

Accidents While Thawing Dualin.

TORONTO, 26th December, 1890.

The Editor :

With each winter season we are called upon to record a number of so called accidents, resulting in the death of one or more workmen. The class referred to are the too oft recurring premature explosions while thawing dualin near a fire, stove or other dangerous manner, in which the dualin is exposed to direct heat or flame, which draws to the surface of the cartridges the over heated and mechanically mixed nitro-glycerine, of which the dualin is largely composed. This over heating or sweating, is the whole cause of the danger, and the accidents which result from it. The proper way to thaw dualin, and the manner in which it is recommended by the manufacturers, is to place the cartridges in a tin, zinc or metal box, which is made with a space for hot water between its outside surface, and with another zinc or metal box which may be lined with wood or the outside surface to prevent too rapid cooling of the hot water. These boxes are sold by the manufacturers whose responsibility ceases when they recommend a safe means of handling the articles they expose for sale. The responsibility, then, rests with the purchaser who causes workmen to use a dangerous article in a wrong manner by not providing the proper means or box for use in thawing dualin. If a box is provided by the employer or purchaser of the dualin and the workmen neglect or do not use it, then the employer is not responsible, but the blame rests with the careless workman, who endangers his own life and that of those around him. We have known instances where the managers of works have been asked to furnish boxes but neglected to do so, or objected on the pretence of cost, which he or they considered unnecessary, and accidents resulted in consequence of thawing the dualin in a wrong way. These officials were then responsible, and ought to have been prosecuted for criminal negligence in exposing the lives of their workmen to danger. This circumstance calls to mind the enquiry, Where is Ontario's Inspector of Mines and Quarries? Does he condescend to note the death of a miner or quarryman? Is he not appointed to protect workmen in seeing that due care is taken in conducting mining and quarrying operations? In the case of the

Ontario Inspector is he not too busily engaged praying for aid from heaven for the poor widow and orphans of the deceased workman, and thereby filling only one end of his lawful calling? Truly this is a wise appointment (an ex-Baptist parson) by the over faithful Premier of Ontario in the interests of those employed in mines and quarries. In the case of Quebec, the Inspector is evidently not required to look after such things as accidents, for the Hon. Mr. Mercier has liberally appointed clerics to Government positions, and the Inspector knows that these can say masses enough for the unfortunate miners and quarrymen who prematurely "go up" as a result of their own or some other person's carelessness in not providing proper protection to employees in mines and quarries.

J. S. T.

Canada's Mineral Wealth.

The following is the pith of Mr. Erastus Wiman's memorable speech at the banquet given to the Iron and Steel Institute at Niagara:—

Mr. Wiman said:—"Canada is a land of surprises, and even to those who know her she is ever revealing some new source of wealth. Who could have imagined that Canada possessed within herself the potentialities for the defence of the world? Yet the visit just made by the Iron and Steel Institute to the Sudbury region, only twelve hours' run from Niagara, discloses the fact that her deposits of nickel are the greatest the world has ever seen. Now, it has recently been discovered by tests made at the United States navy that nickel-plated armour for ships is practically impenetrable for defensive purposes. Well was it said that these tests rendered it possible to make Behring Straits a closed sea, unless, indeed, the British Government drew on Canada for supplies of nickel with an alacrity equal to that with which the United States are making haste to gather it in from the same source." So impressed was the speaker with the importance to Great Britain of obtaining the supplies, that he had communicated an offer on behalf of the Canadian Copper Company to the authorities in Great Britain, tendering them a free supply of nickel from Canada for the tests contemplated at Shoeburyness. "The nations of Europe," Mr. Wiman continued, "seek with anxiety this peaceful land for the force for the defence of the world, as is shown by the visit of a member of the firm of Messrs. Krupp, who seeks, incognito, in the wilds of Sudbury, the power that will make guns unburstable, and armour impenetrable. A contribution to the peace of the world may thus be made by Canada. That may not be the least of her many surprises, but with nickel in Canada, in the region hurriedly passed through by the Iron and Steel Institute, will be found sister minerals in abundance. Thus, in copper the deposits in the regions just visited are the largest in the world. The Aladdin-like story of the Calumet and Hecla mines, of sixty millions of dollars of profits and premiums on the capitalisation of less than three millions on the south shore of Lake Superior, can be retold in Canada in the Algoma district on the north shore, for here there is copper in sight at least twenty-five times the extent of the American deposits. The silver deposits, too, are most extensive, and their character is told in the familiar story of the Silver Islet, which a few years ago yielded within its small area more silver to the square foot than an equal space of the earth's surface had ever given forth. Gold is here also found, and the promise of the Vermillion and other mines equals the prospect of early California or later South Africa. Platinum is found in unusual quantities in these regions; and so complete are the surprises in this treasure-house of the continent that an entirely new metal has been revealed, and named sperrylite, in honour of the graduate who discovered it. Canada is a surprise in that she especially possesses almost untold deposits of the greatest of the world's assets, the Imperial metal, iron, stretching far out to sea in the pier-like projection of Nova Scotia. Within six miles of the Atlantic is found an assemblage of the finest iron side by side with pure limestone, and with coking coal in seams 20 feet thick. These and other near-by deposits so splendidly located are testified to be equal in value to the mineral deposits of Pennsylvania and New York combined, furnishing a providential proffer to New England in her hour of need, if only she will accept it. Quebec, communicating with the iron sands of the St. Lawrence, contains throughout the province enormous deposits, awaiting only the touch of enterprise and an open market for a vast output. In Ontario the recent report of the Royal Commission makes it clear that a surprise awaits the world in the extent and importance of the iron deposits of that fairest and richest portion of the continent. The freedom from phosphorous in Canadian ore is important, and it has been aptly said that what the devil is to religion phosphorous is to iron. In British Columbia, a mineral wealth exists, only equalled by her enormous timber regions, her 5,000 miles of coast line fisheries, and her unlimited coal de-

posits, which recalls another of the surprises of Canada—namely, that it is only within her territory that coal can be found on the sea board equally on the Atlantic and Pacific, a fact of profound significance if this continent should ever wake up to the realisation of the advantages of a foreign trade. Time fails to tell of the numerous other revelations which Canada makes to the observer of natural phenomena, such, for instance, as the possession of natural gas in great abundance within a radius of ten miles of Niagara Falls, to supplement the vast water power which flows at your feet, and which is but a commencement of inexhaustible force in the water powers of the St. Lawrence, the Ottawa, and the great rivers of Quebec, for it is well to realise that Canada, besides being larger than the United States, and in area being 40 per cent. of the British Empire, has more than one-half the fresh water of the globe. Still further surprises await him who follows the development of the oil deposits in the North-West, where, in the Mackenzie river basin, are found deposits of petroleum, the magnitude of which exceed that of the known deposits of the rest of the world. The gypsum deposits in Nova Scotia are the most valuable on this continent, while the eager hunt for asbestos in Canada confirms the recent boast that that Province alone possesses sufficient of the important mineral to pay the Dominion National Debt. In addition to this vast mineral storehouse, one recalls the enormous areas of the wheat-producing regions of the North-Western Territory, the future granary of the world; the five thousand miles of coast line fisheries, the limitless forests to supplement the treeless prairie of the West, and other great national assets. But of all surprises in relation to Canada, that is the chief which blinds both Canadians and Americans, not only to the value of the country, but to the advantage of an unrestricted intercourse between them. It is especially surprising that the people of the United States, now so thoroughly equipped and needing new opportunities for continued expansions of trade, have not yet realised the influences they may set in motion towards shaping that commercial destiny of the continent. This they can do by opening up their markets, promoting development, and making haste to get control by occupancy and by individual purchase of a region far more desirable than Africa, which England and Germany carve in two for the purpose of trade. The Iron and Steel Institute of Great Britain have seen much of the United States, and have, no doubt, been duly and properly impressed with the greatness of their development, the magnitude of their trade, and the beneficial example for the good of mankind. But here, under the British flag, lies a region full of promise, possessing areas, potentialities, and a people fitted for just as great a career, and needing only the magic touch of freedom and appreciation of the American people to enormously enrich them, and yet still be the brightest jewel in the British Crown, without a red coat and without a ship of war. This vast treasure of the British nation may be left exposed as a hostage of peace in the practical safe-keeping of the American people. They will not capture it by conquest, neither will they seek to acquire it by territorial or national purchase, not even imitating their own policy of the past, but will follow the British policy of the present in the acquiring of breweries and other industrial interests by the English capital sent hither. Thus, without a change in the political condition or the deprivation of a foot of British territory, would be healed, by trade and commerce, the great schism of the Anglo-Saxon race on this continent in a new union of interests that nothing could dissolve."

Nickel Steel Tried in Europe.—Commander F. M. Barber, United States Navy, recently received the following cable despatch concerning the latest trial of armour in Europe:—"The Russian navy made a comparative test of three plates of Ohta, the 11th of this month. The plates were ten inches thick. One was of plain steel made by Schneider & Co., of Le Creusot, France; the second was a compound plate made by Brown & Co., of Sheffield, England, and the third was a steel plate made by Vickers, of Sheffield. Each plate received five 6-inch Holtz chrome steel projectiles, weighing 90 pounds each. The first two were fired with a striking velocity of 1900 foot seconds, and the three others with 2100 foot seconds. The Schneider plate arrested all the projectiles and broke three of them. The penetrations were 22 and 27 cm. In the Brown plate the first two penetrated 34 cm., the three others traversed the plate and backing and fell 750 m. in the rear. In the Vickers plate the penetrations were 23 cm. The Brown plate showed large cracks; the two steel plates had only fine cracks. The trial showed once more the absolute inferiority of the compound plate and the superiority of the Schneider plate, a superiority which would have been greater if the plate fired at, at Ohta, and delivered by the Le Creusot works a year ago had been of the same fabrication as the nickel steel plate tried at Annapolis, embodying the latest improvements in the Schneider plates."

Our Portrait Gallery.

[A series of portraits and biographical sketches of Canadian mining engineers, mine managers, inspectors, geologists, explorers, etc.]

Nos. 7 and 8.

Mr. William Madden and Mr. Patrick Neville,
Deputy Inspectors of Mines for the
Province of Nova Scotia.

In this issue we give our readers two very good portraits of the gentlemen who act as Deputy Inspectors for the Provincial Department of Mines, for the Province of Nova Scotia.

The district assigned to Mr. Madden, embraces the Counties of Cumberland, Colchester and Pictou, on the mainland, while Mr. Neville is more particularly concerned with the Island of Cape Breton. Their duties are more inti-

they are frequently called upon to visit gold and other mines, and localities being prospected or in the course of development.

At first the mine managers were apprehensive of undue interference on their part, but it has been found that the frequent friendly inspection has been beneficial to all parties. The men, when they have any cause of complaint in the matters covered by the Mines Regulation Act, can readily turn to the Deputies who live near at hand, and the mine officials benefit by the observation they feel is kept constantly directed on them. A record is kept of all visits of inspection made by them, and an annual summary is published in the report of the Department. These gentlemen were selected for their practical acquaintance with the details of coal mining, and have, since their appointment, won the respect of the coal miners of the Province

by their kindness and tact and evident anxiety to see that everything possible was done to ensure their safety.

Mr. Neville is a native of Cape Breton, having been born at Bridgeport, on the 25th March, 1834. He commenced mining in the employ of the General Mining Association, slope driving and coal cutting, and continued at this work and mining in general until he received the appointment of underground manager at the International Colliery. This appointment he held until May, 1879, when he was transferred to his present important position.

It should be mentioned that Mr. Neville discovered and opened up the Reserve, Emery and Lorway seams, now owned and operated by the Sydney and Louisburg Coal and Railway Company.

Mr. Madden was born at Pictou, N.S., on the 30th November, 1848. For a number of years he was employed underground at Acadia mines and at the Drummond Colliery, after which he worked as a cutter in Maryland, U. S. A. Returning to Nova Scotia, he was engaged in various capacities in mining operations at the Drummond, Springhill, and other collieries, finally receiving his present appointment in 1883.

Good Words for Canada.

(The Colliery Manager.)

Mr. Erastus Wiman in speaking to the members of the Iron and Steel Institute of Great Britain, whom he was entertaining at Niagara Falls, drew such a picture of Canada as must arrest the thoughtful attention of every one who reads it—certainly of every British subject. To the young men—full of life and hope—in our own industry, this thrilling account of the vast resources of Canada must have a charm that those of us who are getting on in years cannot be affected by. Canada, he says—and Mr.

Wiman has a clear knowledge of his subject—possesses almost untold deposits of the greatest of the world's assets—iron. Within six miles of the Atlantic is found the finest iron, side by side with pure limestone, and with coking coal in seams 30 feet thick. Enormous deposits are awaiting only the enterprise of capital to develop them and an open market for the output. We are sorry to find Mr. Wiman turning to the United States for co-operation in opening up the vast resources of the Dominion. Why should not some portion of the British capital which is at present utilized in the United States, or, at any rate, some portion of that which we are told is about to be transferred there, be taken to Canada? Instead of long-ing for reciprocity arrangements with the States, as Mr. Wiman appears to do, the Canadians would be wiser to court extended business relations with their mother country, whose ports are free and where there are no prohibitive protective duties. Stimulated by the freedom of Canadian ports, the commercial relations between the two countries would be enlarged and cemented to the permanent advantage of both. The old country has capital and population—Canada has an abundance of Nature's richest endowments. Canadians have plenty of energy and enterprise, but their entire population is absolutely useless for any speedy recovery of the wealth underlying their enormous tracts of undeveloped country. Surely it can only be necessary to make known how rich the country is, to attract to it the capital and the labour by which its riches can be developed.



MR. WM. MADDEN.

mately connected with the coal mines. Each mine is visited once a month and carefully gone over, particular attention being paid to the air ways, ventilators, and the state of the currents in the working places. The various officials are interrogated as to their care in carrying out the general and special rules, and the state of the roof and walls of the working places receives attention. Usually any neglect or omission referred to by them is readily remedied, but it is sometimes necessary for them to ask the Inspector to assist in a matter involving a fair difference of opinion. Should any matter appear of serious moment the Inspector is notified. The powers of the Deputies for all purposes of inspection are equal to those of the Inspector, and they have full access to all parts of the mines, etc. In addition to this work,



MR. PATRICK NEVILLE.

So far as the deposits of nickel are concerned, the future of Canadian mining appears to have been assured by recent metallurgical discoveries. The value of the metal is shown in the fact that the United States Government has just voted \$1,000,000 with the intention of obtaining a sufficient supply of the metal for armour-plate construction; and the researches of Messrs. Riley, Hadfield and Schneider have been followed by results which undoubtedly give nickel a permanent place as an alloy of steel. The United States' contemplated purchase of the metal, under the impression that it could thus monopolise the entire available supply, does not take into account the enormous resources of Canada in this respect. It would be almost impossible to form an adequate conception of the illimitable supplies in that country. It is known that nickel exists in great abundance over an area of several hundred square miles, and it is safe to conclude from surface indications that the ranges continue for many thousands of square miles, some of them passing through long stretches of unbroken wilderness. It is believed in one district alone, north of Georgian Bay, there is sufficient nickel to be found to serve the world's requirements for a thousand years to come. This estimated supply, too, is made on the assumption that the metal will enter very largely in the future into the manufacture of armour-plates. The

value of nickel for toughening steel has become so generally recognized that at least one eminent firm of continental ordnance manufacturers has been personally enquiring into the resources of Canada in nickel, with a view to obtaining supplies of the metal, and only lately an offer was made on behalf of the Canadian Copper Co. to the authorities in Great Britain tendering them a free supply of nickel from Canada for the tests contemplated at Shoeburyness. The value of nickel as an aid to the perfection of metallurgical processes is so assured to the countries in which it is to be found in any abundance, and this will be particularly the case where the metal can be more economically treated than at present—for we firmly believe that the time is not far distant when nickel will be separated with the greatest facility and cheapness from its compounds. With such admirable possibilities for nickel in the future there is an obvious opening in Canada, which will without doubt lead to practical results in a very short period. This period will undoubtedly be shortened in proportion as the commercial relations between Canada and Great Britain are strengthened since there is every probability of English capital being available to better purposes than that of other countries which still have their own internal resources to develop. Present financial conditions are not favorable to a new boom, but, when the next boom comes Canadian investments are not unlikely to be its object. This is the more probable because it is evident that the opening afforded to new Canadian developments by the McKinley Tariff Bill is not likely to endure beyond the presidential election in 1892.

Meeting of the New Vancouver Coal Mining and Land Company, Limited.

The semi-annual general meeting of the shareholders of this Company was held last month at the Cannon Street Hotel, Mr. John Galsworthy (Chairman) presiding. There was a fair attendance.

The SECRETARY (MR. JOSEPH RAMSDEN) having read the notice convening the meeting, the report and accounts submitted for the six months ended 20th June, 1890, were taken as read. They showed a net profit for the half-year of £7,462 3s. 9d. The total net output of coal for the half year was 121,971 tons, and the sales were 128,390 tons. During the half year over which the accounts extend, the coal market at San Francisco slightly improved; prices have since become still firmer, the continuance of the miners' strike in Australia having given the market an upward tendency; for the remainder of the present year, therefore, the outlook is encouraging. In regard to the East Field Mine, the net output during the half year was 33,477 tons. The coal in the No. 1 north level, north level incline, and No. 3 north level continues good, and about six feet thick. Of the No. 2 South Field Mine, the net output during the half year was 65,428 tons. In the No. 1 and No. 3 east levels the coal is still good, and from seven to nine feet thick, but in some of the other levels faults have been met with which have reduced the thickness of the coal, or cut it out altogether. In order to maintain the output here, the directors have determined to put down another shaft near the No. 6 bore, South Field, where coal was found about nine feet thick at a depth of 496 feet from the surface. The sinking of this additional shaft is now in progress. No. 3 South Field mine was re-opened about the 23rd June last, the market having improved, and 7,082 tons were extracted up to the close of the half year. At the present rate of output, it is estimated that there is about a year's supply still to be obtained from this mine. In new No. 4 slope, South Field, several patches of good coal have been met with, and it is hoped that a good seam may yet be found here; if not, the slope will be used to open up the coal ground to the dip of the main slope at the No. 2 south field mine. The quantity of New Wellington coal extracted from the North Field mine during the half year was 15,984 tons. The quality of the coal continues hard and good, but the seam is not so thick as was expected. The coal is principally used in the domestic trade at San Francisco, and is much appreciated. The daily output from this mine cannot exceed 250 tons until the air shaft is completed; this is being pushed forward with all despatch, and it is believed will be completed before the close of the present year. The superintendent reports that the outlook in this mine is favourable. Mr. Tendron, a member of the board, the report states, very kindly made a visit to the mines in August last, and after fully inspecting the mines and the property of the Company was well pleased with the progress made since his former visit, as also the progress of the Company. A further dividend was declared of £2 per cent. (out of the amount of profit transferred from the old Company), payable on the 20th of December, 1890, (free of income tax), to the holders of shares in this Company, on the 3rd day of December, 1890, on which day the transfer books will be closed.

The CHAIRMAN, in moving the adoption of the report and accounts for the six months ending the 30th June, 1890, said it would not be needful for him to speak at any length, the more especially as more important business had afterwards to be transacted at the extraordinary meeting which was to be held later on. I will, therefore, he continued, content myself with the remark that during the past half-year steady and satisfactory progress has been made in the development of our property, and that, what with the great strikes in Australia, together with a strike on a smaller scale upon a property adjacent to ours, a good business has been done. We have received as usual reports from our agents as to what has been done and is being done down to the present time in the different portions of our property, and these all go to show the different mines are being gradually fully explored and examined, and as a rule with the best results. But these exploratory operations, as you know, require money. We have made a considerable profit, it is true, but that profit is already exhausted in these operations; and without the aid, therefore, of some finance other than our own we cannot continue the work. It is this necessity for further funds, as you are aware, which has resulted in the provisional agreement which has been concluded on our behalf by Mr. Tendron with Messrs. Rosenfeld's Sons, and which will shortly be submitted to you for your approval. You will note that we have declared a dividend of 2 per cent. That is a very small dividend, but we cannot help it, for we have not the money to pay more. It comes from the profits which came over to us from the old company, and I may add that it pretty well exhausts those old profits. We could, it is true, have paid another 1 per cent.—and, indeed, we shall pay that extra 1 per cent. if our financial arrangements are not upset by the rejection of the agreement with Messrs. Rosenfeld's Sons. I have nothing more to say just now, so I will at once move the adoption of the resolution in regard to the report and accounts. (Hear, hear.)

Mr. FRY seconded the motion, which was agreed to unanimously.

Mr. BLUNDELL: In regard to our having no money available, sir, I should just like to point out that, according to the accounts, we have £2,000 invested in Metropolitan Stock, so that unless our holding has since been sold out we have there a very considerable sum available. I am glad to learn from your explanation where the £2 divided is obtained from, since, as far as I can see, there is nothing in the accounts to show it.

Mr. DAY: What is the difference in the selling value, roughly, between the New Wellington coal and the ordinary coal? The new kind, we are informed, is highly appreciated for certain purposes, and apparently it is more valuable than the older sort. What is the difference in value?

The CHAIRMAN: The Wellington business is virtually in a state of chaos at this moment in consequence of the strike, and very little coal is being sold. This is advantageous to us, since it has enabled us gradually to get more and more of their business, though we are not able to supply very much at present—only 250 tons per day, in fact. For that, however, we are getting about half a dollar more than the Nanaimo coal, and about the same price as the Dunsuir coal.

A SHAREHOLDER: I see that no less than £2,000 has been expended during the past six months in repairs and maintenance. Are we not making it a very good thing, indeed, for Messrs. Rosenfeld's Sons by all this outlay, which would represent an enormous sum if capitalised?

The CHAIRMAN: You do not quite understand the matter, I think. It is absolutely necessary, in our own interest, that money should be expended in repairs and maintenance.

Mr. TENDRON: There is much apprehension over this agreement. Perhaps, sir, as the author of it, you will allow me to explain to the meeting that, in regard to the particular point raised, any capital charges which henceforward are debited to us, will afterwards be repaid by Messrs. Rosenfeld's Sons. Already over £67,000 will be paid in this way by them. Whatever we spend out of profits will have to be repaid by them on this basis. We must try to put the property into better condition for our own sake. It is absolutely necessary that we should have money to carry on current work. Whence are we to obtain it? We have been unable to get it from our shareholders or from the public. Messrs. Rosenfeld's Sons have, on the other hand, helped us for years. They have a high opinion of our property, so high an opinion, indeed, that they are anxious to become partners in it to a still larger extent, and we, for our part, being in want of funds to develop it, are quite prepared to agree to this upon favourable terms. And it has been to this end that the agreement in question has been drawn up. We think its terms are favourable, and we hope that you will think the same. We shall still have the right to retain a one-third in the whole. The bargain is one, indeed, by which we cannot lose, and have everything to gain. If Messrs. Rosenfeld's Sons do not buy ultimately, they are bound to take up £50,000 of our shares at par.

The CHAIRMAN: In regard to Mr. Blundell's question about the dividend, I should have stated just now that

we took over £20,000 from the old company. With this 2 per cent. we shall have distributed £15,400, leaving a balance of £4,600, and we propose to give you another pound if we have the money. In the accounts, the balance is, of course, in the amount carried forward.

The resolution was agreed to without dissent.

• The extraordinary general meeting was then held.

The SECRETARY having read the notice convening the meeting.

The CHAIRMAN said: The following is the resolution which I have to make:—"That the agreement dated 1st September, 1890, negotiated by Messrs. Tendron and Robins on behalf of this company (provisionally) with Messrs. John Rosenfeld's Sons, of San Francisco, for extending the period for bonding the company's property at Nanaimo to them from the 31st December, 1890, for providing funds for certain specified explorations and works, and for other purposes, be sanctioned and adopted, and that the directors be authorized to carry the same into effect." You have all had copies of the agreement, and it will only be needful for me to refer to one or two points in it. First of all I would call your attention to the fact that in clause 5 an important alteration has been made since the draft which you received was printed. As originally drawn up, 20 per cent. was the amount fixed upon to be paid in a certain event. That proportion has since been altered from 20 per cent. to 33½ per cent. Well, in regard to the agreement itself, it was brought about, as you know, in consequence of the visit of Mr. Tendron to America last summer, and was only arrived at, as he will tell you, after prolonged and laborious negotiations. The only point in the agreement to which any real objection is at all likely to be taken is clause 5, which runs "At any time during the currency of this agreement, the firm to have the call of £150,000 new shares, or any part thereof on which 33½ per cent. is to be paid by them on issue, subject to the Articles of Association of the Company. The Company's indebtedness to the firm to be received in payment or partial payment for the shares. The other share capital to be issued without the firm's consent." I think you will be justified in taking the earnest advice of the Board upon this matter, and sanctioning this agreement, in the complete assurance that the interests of the Company have been protected and advanced by it in every way, and that it cannot fail to have any but a beneficial effect upon the fortunes of the Company. I may, perhaps, just remind you in conclusion, that should the agreement be rejected by you, we shall find ourselves placed in a most embarrassing position, from which I cannot tell how we should extricate ourselves. I beg to propose the adoption of the resolution which I have read to you.

Mr. TENDRON seconded the motion, which was carried unanimously.

A Large Electric Mining Plant.

The electric power plant being put in by the Virginus mine at Ouray, Col., is one of the largest in the world, and is the first electric power of such extensive proportions used in mining. A power house has been erected at the confluence of Imogene and Sneffles creeks, which is 30 x 60 feet. Two heavy copper wires are poled from here to the mine, 19,000 feet away, to convey the electricity to the mining and milling machinery. In the power house are two dynamos of 400 horse power each. The dynamos are operated by water power, obtained through a mile of pipe line, driving two mammoth Pelton wheels. The water is taken from Canon creek, and has a fall of 600 feet. The pipe line is nearly complete, and the machinery is about all in place, and it is expected to start the new plant in about three weeks. All the machinery for mine and mill will be operated by electricity at both the Virginus and Terrible mines. The largest Knowles duplex mining pump in the world will be placed at the tenth level of the Virginus mine, and will be operated by a 50 horse-power motor attached. This pump will throw a 6-inch column of water 700 feet, to the adit level, or surface. A great amount of money is expended in the large electric plant, but the reader will readily understand how well this expenditure is justified when it is stated that the Virginus and Terrible have been using 13 tons of coal per day, at \$20.80 per ton, every day in the year. This vast expense will now be cut off. The coal supply has been packed from Ouray, a distance of 13 miles. The cost to the Virginus for fuel since 1887 would give any individual all the money he would ever need to live in luxury. Since electric power has been used in mining it would have saved several hundred thousand dollars at the Virginus. With the new power plant and pump the Virginus will be one of the best systematized mining enterprises in America. —Black Diamond.

The Hauraki Gold Mining District, (Northern Section) Auckland, New Zealand.

BY D. H. BAYLDON, M.E., THAMES, NEW ZEALAND.

[Proceedings of the Federated Institute of Mining Engineers.]

The Hauraki mining district, in the Province of Auckland, New Zealand, lies between latitudes $36^{\circ} 25'$ and $37^{\circ} 40'$ S., and longitudes $175^{\circ} 20'$ and $176^{\circ} 0'$ E., is about 100 miles long by an average of 25 miles wide, the greater portion being known as the Coromandel Peninsula.

It is bounded easterly by the Pacific Ocean and westerly by the Firth of Thames and the beautiful fertile valley of that name, the extreme northern limit being Cape Colville, and extends southward beyond Te Aroha mountain, 3,173 feet high.

The country for the most part is rugged and mountainous, covered with dense forests of ever-green trees, intersected by innumerable streams of various sizes, which afford at all times of the year a magnificent supply of pure water for mining, timber floatage, and domestic use.

The timber on the ranges is of vast extent. Here is found the celebrated Kauri pine, from 70 to 150 feet high, some of the boles of which have been known to exceed 20 feet in diameter. Other valuable timbers exist, suitable for building, cabinet, fencing, mining, and domestic purposes. The Kauri gum, a hard substance, somewhat like amber in appearance, and which is exuded from the pine of that name, is found in the existing and extinct forests in great profusion, and is a source of wealth to the country; it is exported to England and America, where it is highly esteemed and manufactured into the finest carriage varnish.

The valleys are salubrious and fertile, composed of deep alluvium, and are, to some extent, cultivated by the Maori miners, and settlers. The crops are such as are grown in England. All English fruits are abundant and good. Stock of all descriptions thrive and do well.

The situation of the Hauraki mining district is some-

FIG. 2.



what unique as a gold-field, the facilities offered for the export or import of material being all that can be desired, sea carriage being afforded almost up to the pit-mouths in the instances of Thames and Coromandel. The noble and picturesque harbour of Auckland is within 40 miles of the former and 30 miles of the latter town, where ships of any draught may lie and discharge at the wharves with the greatest safety.

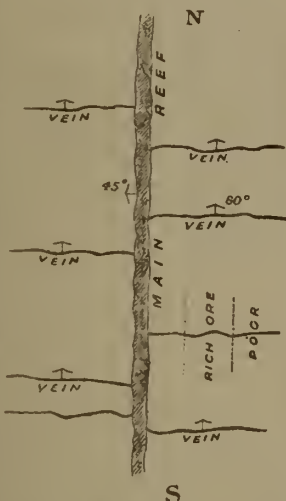
Local steamers carrying passengers and freight run at regular and frequent intervals between Auckland, Thames, Coromandel, and Mercury Bay, from whence they distribute their freight to other points by drays, coach, or river.

The Thames or Waihou River drains the south-western section of the district: it is navigable for small steamers and craft for some 60 miles on its course. Inside the river, for several miles, exists a natural harbor, suitable for vessels up to 600 tons register. The land is rich and fertile, forming a broad valley 15 to 20 miles wide, perfectly flat, intersected by other streams. The ground is somewhat swampy, which is natural from its conformation, but for the most part easily drainable. Here the *Phormium tenax*, or native flax, covers large

areas and fringes the river banks; the white pine, a very useful timber, is also abundant. Much of this land, especially in the upper part of the valley, is reclaimed, and flourishing farms are to be seen as far as the eye can reach.

The lands on the eastern bank of the river are now nearly all occupied by a hardy, industrious class of farmers, many of whom are now and have in days gone by been engaged in mining pursuits.

FIG. 1.



Such is a brief outline of the Hauraki mining district, and it will be seen that mining and agriculture can go hand in hand. Twenty years ago it was a howling wilderness: now there are many small towns, and villages, the country dotted over with farms, the miners penetrating the hills in search of the precious and other metals, and the country made accessible by roads and bridges. The future of such a country is not hard to predict.

The principal centres of mining in the district are Coromandel, Hastings, Thames, Hikutaia, Ohinemari, (comprising Karangahake, Owaharoa, Waihi, and Waite-Kauri), Te Aroha, including Waiorongomai.

Gold was first discovered at Coromandel in the year 1851, and attracted a considerable number of miners, but through native troubles, and superior attractions elsewhere, the diggings became comparatively deserted until 1861, from which time mining has been carried on, with more or less success, to the present day. Considerable tact was required to be displayed in dealing with the natives to induce them to open their land to the miners for prospecting and mining. All these difficulties have for many years been overcome; cordiality and mutual good understanding now prevails on both sides.

Coromandel is situated on a beautiful little harbour, and mining for gold is carried on from the sea beach across the main range toward the east coast. Coal and other minerals are found throughout the district, but are undeveloped.

The principal gold mines are the Kapanga and Coromandel (English companies), Tokatea, West Tokatea, Royal Oak, Pride of Tokatea, Success, Onslow and many others.

Throughout this district the outcrop of a main or mother reef can be traced for many miles, averaging 25 to 30 feet thick, with a northerly strike and westerly underlie of about 45 degrees. It has not been found payable, but the lateral veins, which have an east and west strike and northerly dips of varying angles, are found to yield good paying ore, which, as a rule, lies in "chutes" or chimneys of varying widths and depths. These lateral veins vary from a few inches to several feet in thickness. The Tokatea Mine, in which this system of reefs is well illustrated, is situated on the main range, the highest point being about 1,400 feet above sea-level; it is worked by adits down to a depth of 900 feet, the lowest level being about 2,500 feet long.

The Kapanga Mine is situated about one mile westward of the main reef; two well defined reefs have been

worked from the surface to a depth of 550 feet. It is worked from a main shaft, properly equipped with pumping and winding machinery, capable of going to a much greater depth.

Some of the ore from this mine was exceedingly rich, and in places highly charged with metallic arsenic, which, in the course of amalgamation, had the effect of sickening the quicksilver, which, consequently did not do its work, entailing considerable loss of the precious metal.

The Coromandel Mine is situated on the sea-shore, above high-water mark. The company are doing good work, opening up new blocks 280 feet below sea-level.

The pumping and winding machinery is situated on the sea-beach, the mine being worked by two shafts about 450 apart. The inland shaft, being about 120 feet above sea-level, and the deepest by 100 feet is connected by sweep rods to the pump-

ing engine, the water being pumped to the 180 feet level, from whence it runs back to the seaward shaft, and is then forked to the surface. The drainage water from the mine is settled in a reservoir and used for milling purposes.

The country rock in which the lodes are encased is of igneous origin, of a tuffaceous nature, highly charged with undecomposed pyrites, below water-level sometimes coarse and rotten, in other cases fine grained and hard, and has been termed "tuffaceous sandstone," and in this class of country rock only have the lodes been found payable. Alternating with the tuffaceous sandstone are to be found slates, diorite-porphry, and felsites.

Hastings, some 20 miles south of Coromandel, is a small mining township. Considerable quantities of gold have from time to time been found in the various gullies and spurs off the main range, chiefly in decomposed slate and tuffaceous sandstone. No deep mining of any consequence has been done here.

Thames is the center and most important locality in the Hauraki mining district. It was opened for mining in the latter part of the year 1867, and has been constantly worked since that date.

The population was at one time 10,000 to 11,000, but being chiefly composed of miners, otherwise diggers, who are a roving set of men, attractions elsewhere has reduced the number to something like 4,500 at the present time.

The auriferous portion of the Thames is several miles wide, and the distance back into the ranges uncertain, as not more than about six miles in a straight line has been explored for gold.

The country rock is composed of tuffaceous sandstone, alternating with diorite and andesite dykes. The latter are extremely hard to penetrate, and are known locally as "hard bars." The highest points in the locality are chiefly composed of this class of rock. The country is broken and irregular, intersected by gullies and cracks, which afford excellent opportunities for mining by means of adits or tunnels.

The lodes have varying strikes between 10 degrees and 80 degrees northeast, and usually underlie to the north-west of angles ranging from 22 degrees to 80 degrees from the horizon. They are variable in thickness, from a few inches to 20 feet, and all are more or less gold-bearing while traversing the tuffaceous sandstone.

The pay ore, as is usual, lies in "chutes" of varying lengths and depths, the best paying reefs have hard walls, to which the quartz, in a great measure, adheres, which gives the impression that when the rocks were in a state of fusion they emitted certain gases, which, with other combinations when the rocks cooled, caused the deposition of gold in the veins. The deposition of gold is especially noticeable where lateral breaks occur, and which have the appearance of water channels.

Where the break does not cross the lode the chute of rich ore is of much greater extent, and the lode richest on that wall which has been subject to fracture, and the deposit of gold becomes weaker the further it recedes

FIG. 3.

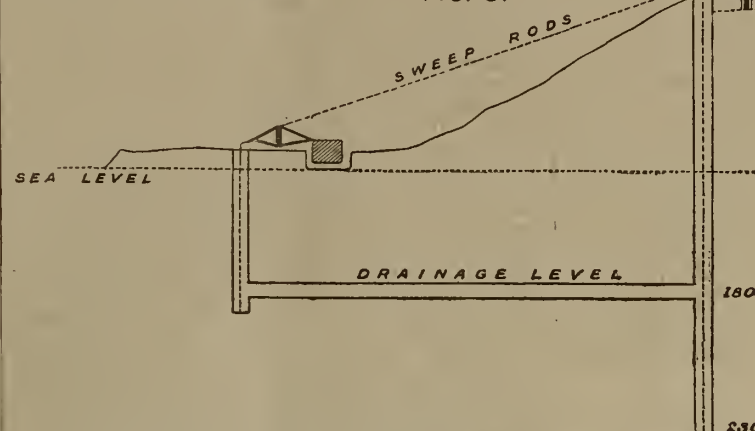


FIG. 4.

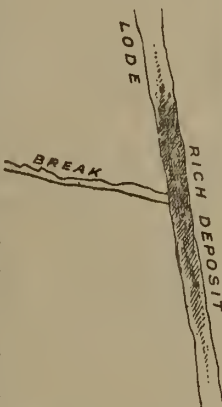


FIG. 5.

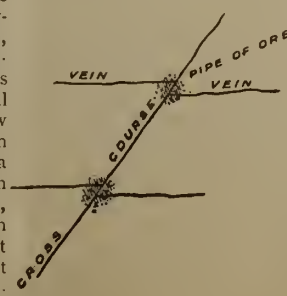
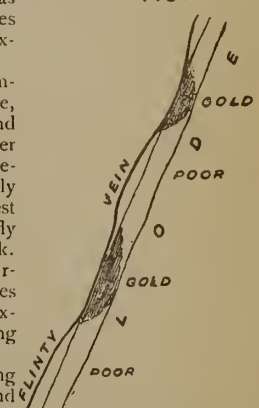


FIG. 6.



History Museum on Sunday afternoons, and thus afford all who wish to avail themselves of the privilege, an opportunity to read and study the sermons from the *work* of the Creator, which there lie open for perusal, written as it is in the only original, universal and uncorrupted language, and one with which the whole human race is more or less familiar.

Sermons, silent it is true, yet—especially to the student of the language—unsurpassingly eloquent—sermons which, I venture to say, would be more intelligible and more interesting to most minds, and no less useful, if regarded from a moral and educational standpoint, than those sermons from the *Word* of the Creator, which some at least of the afternoon Museum congregation may have listened to during the forenoon in Church, which may, or may not, have been either interesting or eloquent. As official reports are seldom read, I may be excused for quoting here the following remarks which were made in my annual official report in 1885, on the subject of Museums:—

“Referring to Museums, it may not be out of place to call attention to what is being done elsewhere in this connection. In New South Wales, one of the Australian Colonies, with a population of only about 850,000, I find from a report recently received, that the appropriation for the year 1884 for the maintenance of the museum in Sydney was £8,750 stg., or about \$43,750. The figures relating to the visitors to the Sydney Museum are also somewhat remarkable. They are for 1883; 137,401 being for week days, 86,114, Sundays, 51,287. Apparently—I might have said conclusively—showing that there is a very large class of persons whose daily avocations prevent them from taking advantage of the means of instruction and the ennobling influences which these studies of nature's wonders in a well-arranged museum cannot fail to afford. In this matter the Australian Colonies must be conceded to have made an advance in the promotion of knowledge and civilization. I would respectfully suggest for the serious consideration of the Government the desirability of permitting the Ottawa museum to be open for visitors on Sunday afternoons.”

No action was taken on this suggestion and in 1888 the subject was again referred to in my official report, when I said:—

“The result of this course having been adopted at the Australian Museum in Sydney shows that on the 52 Sundays—afternoons only—the daily attendance was largely in excess of that of the 313 week days; the average being 986 on Sundays and only 275 on week days. Such a fact needs no comment, and I venture again to express a hope in the interests of education and knowledge that the time is not remote when a similar experiment will be tried in Ottawa.”

There will, doubtless, be strong objections urged against such action, based chiefly, if not entirely, on the very erroneous, but unfortunately very prevalent, idea that a museum is a place of amusement, whereas it is essentially as much a place of instruction as are the Churches and the Sunday Schools. And the principal difference between them, concisely stated, is, that in the Museum the *work* and in the Church and Sunday School the *word* of the Creator is expounded. This admitted, as I think it must be, there seems no obvious or intelligible reason why the one establishment should be closed and the other opened on the Sabbath. And now with your permission I shall make a few remarks on the past and present position and prospects of the Ottawa Museum. In the early reports of the Survey, there is so far as I am aware, no reference to the Museum nor any statement of its first establishment, or of its annual growth—like Topsy, however, it “grewed.” In the preface to the *Geology of Canada*, 1863, on pages xiii to xv it is briefly described, and we learn that “the Museum has gradually assumed a value and importance which at the present time (1863) render it second to few on the continent for the special purpose to which it is devoted.” It was then divided into two parts Mineralogical and Paleontological, about 1,500 species of fossils were exhibited, and an unrecorded number of specimens of rocks and economic minerals. It was located in an old dwelling house on the corner of St. Gabriel Street and Fortification Lane. Prior to 1873 no record was kept of the number of visitors, but in that year 1,000 names were recorded; in 1874, 1,017; in 1875, 1,728; 1877, 1,980; 1879, 1,603, 1880, 1,183.

In 1881 the Museum was removed from Montreal to its present location in Ottawa. In 1882 9,000 persons visited it; and during the year just closed the number of visitors has reached 18,300. During the past twenty years, it has been my constant endeavour to increase the practical and the educational value, as well as the attractiveness and popularity of this Museum.

In this endeavour I have always received most valuable co-operation and assistance, without which my endeavours would have been fruitless, from the gentlemen who have been, or still are, associated with me in the work. Judging from the number who now visit the Museum, I am, I think, justified in assuming that our united efforts have have met with some measure of success, notwithstanding

the difficulties and hindrances that have been encountered, incidental chiefly to the very inadequate accommodation and unfitness of the building for the purposes to which it has been adapted. A far more serious consideration, however, in connection with the building, is its location and surroundings. These are now such as to constitute an ever present danger of the whole of this large and invaluable collection being at any moment destroyed by fire. This danger can easily be avoided by taking prompt action with a view to erect as speedily as possible a suitable and wholly isolated and fire proof building to receive the collection. Should it in the meantime be destroyed the loss would be wholly irreparable, while the few thousand dollars required to place it in safety are comparatively quite insufficient, and I can only express an earnest hope that no injudicious parsimony will be permitted to interfere with the accomplishment of this important public work.

The establishment of the Royal Society in 1882 through the enlightened and active influence and interest which was shown by the Marquis of Lorne in the promotion and encouragement of all matters pertaining to literature, science and art, and the subsequent recognition of the important functions of the Society by Parliament, in providing funds to defray the cost of publishing the annual record of its proceedings, was a memorable event in the progress and promotion of literature and science in Canada, and a boon for which all literary and scientific workers in the Dominion must always be grateful. Now, one, and by no means the least useful, of its functions is that of constituting a headquarters, or nucleus from which sympathy, support and encouragement is extended to local societies, and where annually a report can be made, and a record published of their several proceedings. Nineteen societies are now affiliated with, and send delegates to the annual meeting of the Royal Society. Of these there are four in Montreal, three in Quebec, four in Ottawa, three in Halifax; and one each in Toronto, St. John, Belleville, Hamilton and Winnipeg. There is, also, the very useful Entomological Society of Ontario whose meetings are, I believe, held in London. Only eight of these societies receive a small annual subsidy from the respective Provincial Legislatures while the others are entirely dependent on the members subscriptions and on voluntary contributions. Nearly all the Fellows of the Royal Society are also members and active workers of one or other of these local societies. I have not been able to ascertain the total aggregate membership of the local societies, but it must constitute a numerous and influential body of workers, probably two to three thousand strong, whose labours are certainly deserving of a larger share of material support and recognition than has hitherto been accorded them by the public, and it is to be regretted that in some instances even the small public grants hitherto awarded have been withdrawn. However, we must not be discouraged or turn aside, but continue the good work, patiently, industriously, honestly and hopefully to the end, forgetful of self and seeking only the truth as it is in nature, actuated by these motives our cause will triumph and our work will meet its reward.

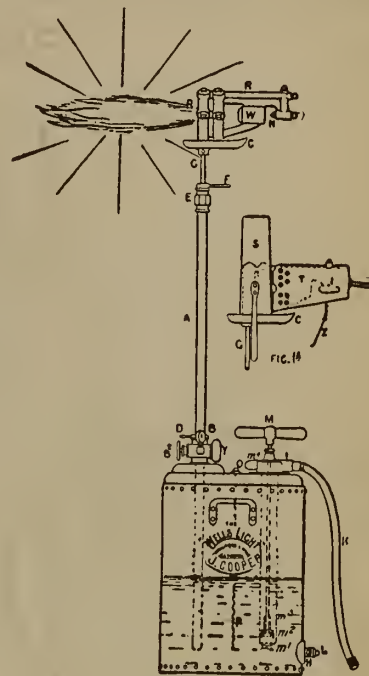
* NOTE.—The considerable increase in the number of visitors between 1875 and 1879 may be ascribed probably to two causes: The awakened interest in the mineral resources of the country caused by the preparation of the collections for the '76 Exhibition in Philadelphia and the '79 Exhibition in Paris, and secondly to the subsequent publication of the descriptive catalogues of the exhibition, and also the publication of the lists of the Survey publications in 1873, 1876 and 1879. The much greater increase after removal to Ottawa from '82 to '89 is in great part the result of the scope of the Museum having then been enlarged to embrace Natural History or Biology as well as Geology and Mineralogy, and thereby having been made interesting and attractive to a much larger number of persons. The list of publications just issued, of which copies are on the tables, gives further details respecting the Museum and the Survey publications to the close of 1889.

British Returns of Colliery Labor.—An analysis of the return of the hours worked at collieries made for the Miners' Federation of Great Britain, by the checkweighers and lodge secretaries in the federated districts, shows that at 679 collieries, employing 183,720 men underground, the general average time worked at the face by the collieries is 8 hours 25½ minutes per day; boys, 8 hours 48 minutes per day; and day laborers, 8 hours 49 minutes. The average time spent in travelling underground is stated to be 39 minutes daily. According to the parliamentary return compiled by H.M. Inspector of Mines the average number of hours worked per day from bank to bank by men and boys engaged in getting minerals in the United Kingdom is 8½ hours, as compared with 7½ hours, the average time per day actually worked at the face. The usual number of days worked in the United Kingdom averages 5½ days per week.

MACHINERY AND INVENTIONS.

The Well's Light.

There has long been a demand for a powerful, portable lamp or service in situations where night work is required to be carried on, as in the case of repairs on railways, in the construction of engineering work, in open quarries, in building operations, upon docks, wharves, etc., and until lately, the only methods of illumination in use for these and similar purposes have been the employment of hand lamps and torches, which are, in nearly all cases, utterly inadequate for the purpose; or of the powerful central lights as represented by the lime light and the arc electric light. The last named devices, while affording ample illumination for the required service, have certain disadvantages with which all of us are familiar, the principal of which are the blinding effect upon the eyes, of their intense and concentrated light, and the blackness of the shadows which they throw, and which result in rendering objects, not directly illuminated by the light, more obscure than where a number of lights of feebler intensity are employed.



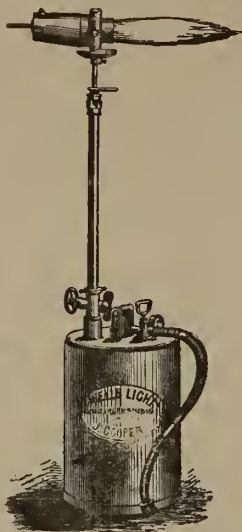
To meet the needs of night service in situations where a strong but diffused light is the desideratum, powerful oil lights have been devised, ingeniously controlled by mechanical feeding devices, so as to place at the service of the workman a light of any desired intensity, and with a large volume of flame. In this respect these oil lights differ radically from the powerful concentrated light afforded by the electric systems. They are capable of yielding an equal amount of light with the last named, but the light, being made by a flame of considerable volume, the eye is not paralysed by its dazzling glare, and the shadows cast are not objectionable in their contrast with the directly illuminated spaces.

We describe and illustrate herewith the construction and operation of one of these oil lights for night service, or for underground works, that has achieved a remarkable success in England, and that is now being introduced into Canada by Mr. James Cooper, Montreal. It is known as the Wells Light, and the accompanying description will be made intelligible by consulting the illustrations.

The Wells Light involves the use of Kerosene oil, confined under pressure in a strong reservoir, from which it may be automatically fed to the burner, the reservoir containing a quantity of oil capable of burning a number of hours. Fig 1 shows a sectional view of one of the Wells Lights. It consists of a steel tank, constructed so as to be air-tight, and therefore capable of holding the

oil without leakage under considerable pressure. When the light is to be operated, oil is first pumped into the tank by the aid of the pump M, until it is about two-thirds full. By this action the air in the tank is compressed, and the pump is again used, if necessary, to develop the pressure up to 20 pounds as will be indicated by the gauge; and with this pressure the light will run for four hours without further attention.

The mode of starting the light is as follows: Preparatory to opening valve B., by which oil is admitted to the burner, a small quantity of oil is placed in the dish C, and ignited, while a chimney and back guard cover the burner, (as shown in fig. 1, A), thereby directing all the heat into it. When the burner has become sufficiently heated, which takes seven or eight minutes, the valve B is opened, when the pneumatic pressure drives the oil through the stand pipe A, running from near the bottom of the tank to the burner. When the oil reaches the generating rings of the burner, it is vaporized, and, passing out of the jet N, through the rings, keeps them at a suitable heat continuously to vaporize the oil as it flows to the burner, and as an excess of heating surface is allowed in the rings, the light burns as well in bad weather as in fair weather, and is neither affected by the rain cooling them partially, nor by the wind, as the burner can be swiveled to run with it.



The whole apparatus is simple and strongly made. Any laborer, after one lesson in its use, can manage it successfully. The Wells' lights are given solely into the care of the laborers on the Manchester ship canal in England, and are said to be the only artificial lights used on this great engineering enterprise, where they have contributed materially to the rapid prosecution of this work.

Fig. III, illustrates the No. 1 Wells Light, showing how readily it can be carried about the work from place to place, where the job is not very extensive. Different arrangements have been devised to adapt the lights to all

purposes. Among these may be mentioned a carriage to carry it about; a tripod stand so that the light may be situated away from the tank when this becomes necessary or desirable; and different kinds of posts for elevating the light in fixed places.

The following valuable and useful features are claimed for this invention: It gives a powerful light, is portable, entirely self-contained, requiring no exterior motive power, is simple in construction, easy to manage, and requires little attention.

Steam Boiler Tests as a Means of Determining the Calorific Value of Fuels. *

By D. W. Robb, Amherst, N.S.

It will be recognized by those who use large quantities of fuel, especially of bituminous coals, that they differ very greatly in value, even coals which are taken from adjoining areas give very different results, so that it is sometimes very puzzling to the consumer and difficult to decide upon the merits and proportionate values of the fuels within his reach. It is likewise difficult to determine when the greatest practicable amount of work is being obtained from the fuel, and consumers are frequently subjected to great loss from the want of this knowledge. There are three recognized methods of determining the calorific value of fuels, viz.: by chemical analysis, by the use of calorimeter, and by actual measurement of the water evaporated by a definite amount of fuel in a steam generator. By the first method, it is possible to ascertain the constituents of the fuel in their various proportions, and to determine the theoretical heat value when combined with a definite proportion of pure oxygen, and approximately to compute the amount of heat which would be converted into work when combined with ordinary air, and consumed under usual conditions. But this becomes a complicated problem, as will be seen when it is considered that the heat absorbed and wasted in heating the non-combustible constituents of both the air and the fuel must be taken into account, and that these wastes vary with the amount of superfluous air admitted through the grate, and with the proportion of noncombustible matter in the fuel, therefore, any estimate of the practical value of a fuel deduced from chemical analysis can only be approximate. In testing fuels by a calorimeter, a sample of the fuel mixed with chlorate of potassium is placed in an open mouthed copper vessel, which is submerged open mouth downward, like a diving bell, in a vessel containing a measured quantity of water, combustion of the fuel takes place and the heat produced is absorbed by the water, the total quantity of heat being determined by the rise in temperature of the water. This method has some advantages over an analysis and, if care is exercised in the selection of samples to be tested—or a large number of samples tested—is perhaps the best means of establishing a theoretical standard calorific value of a fuel, but the quantity tested is necessarily small and may not fairly represent the fuel; it also leaves out the heat absorbed by the non-combustible portions of the air and fuel, which is an important factor in the combustion of fuel, under ordinary conditions. The method by which the fuel is consumed under actual conditions and in large quantities, in evaporating water in a steam boiler is generally regarded as a test of the efficiency of the generator, rather than as a test of the value of the fuel, but somewhat extended observation of the performance of various steam generators using similar grades of coal has convinced the writer that the steam boiler test, when properly conducted, is quite as valuable as a means of determining the calorific value of fuel, and of comparing various fuels as for finding the efficiency of the generator; in fact, the latter is the more uncertain of the two, because, unless a boiler is tested with a fuel of a known calorific value, it is impossible to arrive at its actual efficiency or to compare it fairly with any other form of generator. In testing the heat value of fuel in an ordinary steam boiler two elements of uncertainty are introduced, viz., loss through imperfect combustion of the fuel, and the escape of gases at a higher temperature than the atmosphere, but as these losses, as well as the heat absorbed by the noncombustible portions, the air and fuel are unavoidable in the present state of science, they should be taken into account in making a practical test of fuel, and strict accuracy only requires that the loss be uniform and minimum in result. Practical experience teaches that almost perfect combustion may be attained in any of the common forms of steam generator by careful and regular stoking with a proper air supply; and, that the skill necessary to produce this result is possessed by many ordinary stokers, who have no knowledge of the laws which govern the combustion of fuels, will doubtless be admitted by many persons who have observed locomotive firemen or others, who are compelled to get a high rate of steam production. It is of course impossible to transfer all the heat produced in combustion to the water

in a generator, because the gases cannot be reduced below the temperature of the water or steam within the generator, and a certain temperature above the atmosphere is necessary to produce draught in the chimney, but it is quite possible to so proportion the grate surface to the heating surface of the boiler that the gases will be reduced to a certain minimum temperature, and maintained at that temperature during a test. The temperature may be indicated by a pyrometer or high registering thermometer at the base of the chimney, and the rate of flow of the gases may be ascertained by the use of a draught gauge. Frequently an attempt is made to analyse the waste gases, this gives an uncertain result on account of the difficulty of getting representative samples of the gases, but from observation and examination of many tests the writer believes it unimportant, if the stoking and air regulation receive proper attention. The surface of the grate should be so proportioned to the heating, or heat absorbing surface of the generator that the gases will, when they reach the uptake, be reduced to say 400° Far.; the skilful firing and air regulation will produce practically perfect combustion, and uniform temperature. It is not of so much consequence either, as some people imagine, what kind of generator is used. The brick furnace is supposed to possess an advantage in maintaining the temperature necessary to perfect combustion, while contact with the cooler surface of a water lined furnace is supposed to prevent ignition of the volatile hydro-carbons coming from some fuels, producing carbonic oxide; but the writer is convinced that, by a proper regulation of the fire, so that the air will pass through and the gases pass over a bed of hot coals, or incandescent carbon, with frequent and even distribution of the fuel, as perfect combustion may be, and is, obtained in a water lined furnace as in a brick one. The water lined furnace avoids the radiation of heat and admission of air, both of which are an uncertain but certainly wasteful feature of the brick furnace. Steam boiler tests, although attended with some difficulty, are quite within the reach of ordinary consumers, and deserve to be better understood and used more than they are. In addition to their value as a method of determining the heating properties of fuel, they furnish the best possible means of ascertaining the condition and efficiency of the generator, and of checking, and if necessary correcting waste on the part of the stoker. It is desirable that such tests should be made frequently, because steam boilers are very liable to deteriorate and become wasteful, especially when set in brick, through the cracking of the brick walls, as well as by the coating of heating surfaces with scale or other deposits on the inner, and soot or ashes on the outer surfaces. It is quite practicable for steam users to have tests made by their engineers and ordinary assistants, but it is preferable to have an occasional test made by a professional engineer who has had experience in making such tests, as he will have gained special knowledge which will enable him to detect and locate imperfections in the generator more readily than those unaccustomed to such work. The writer would suggest to steam users the following practice: That one or more tests be made by an expert to determine the efficiency of the generator, and that he may direct any necessary repairs or corrections in the generator. After this has been done, and a standard of efficiency established, a good water meter should be inserted in the water supply pipe, so that a record of the water used may be continuously kept, and the stoker or engineer should keep a log and make daily reports of the coal consumed and the water evaporated. The meter readings will need correction, if absolute accuracy is desired, but for practical purposes this may not be necessary. It may seem like unnecessary labour and expense to weigh all the coal used, but a short trial will undoubtedly prove its value, as it will not only indicate, constantly, the condition of the generator, but to a certain extent, be a check upon the working of the engine and the amount of power used by the establishment, and it will furnish a constant incentive to the engineer, stoker, and those in charge of the steam machinery, to improve its working and reduce the amount of fuel consumption to its lowest limits. A general practice of this kind throughout the country would induce a rivalry in the saving of fuel, parallel to that found in marine practice, where it is claimed a horse power is produced by from one and a-half to two pounds of fuel per hour, instead of four to ten pounds,—the last named quantity being not uncommon in ordinary steam plant, and would in course of a few years cause an enormous saving to the country, as well as to individual consumers. Rules governing the standard system of boiler trial, adopted by the American Society of Mechanical Engineers may be found in the transactions of that Society, vol. vi, 1884. The following simple instructions will enable any steam user to conduct a test of his boilers for the purpose of comparing the values of fuels, etc., after the efficiency of the generator has been established by a complete test by an expert, (observations of the quality of steam, strength of chimney draught and analysis of gases are omitted as they require special instruments and skilled manipulation).

INSTRUCTIONS FOR CONSUMERS' TEST.

A test to be of any value should be continued for not

* A paper read on Dec. 8th, 1890, before the Nova Scotia Institute of Science, Halifax, N.S.

less than ten hours, and will require the constant attention of not less than four persons besides the regular attendants, appointed as follows:—One or two men to weigh the coal, and one or two to attend to and weigh the water; one clerk to keep the log of the coal and water weighed, and one clerk to record the pressure of steam, temperature of feed water, temperature of chimney gases, and to keep a gross account of the coal and water as a check to the regular log. These should be careful men, well posted as to their duties. Three good platform scales will be required, and two tanks, or clean tight casks, to weigh water in. Preparation should be made so that the water can all be delivered into the two tanks, which are placed upon two platform scales, and the water pumped alternately from the tanks to the boiler. A piece of hose attached to the suction pipe of the pump or injector will be convenient to transfer from one tank to the other. It will be advisable to procure from reliable instrument makers one or two accurate thermometers for the purpose of taking the temperature of the feed water and chimney gases. The temperature of the feed water should be taken by inserting a brass or copper cup in the feed pipe near its connection with the boiler. This cup may be filled with oil and the thermometer set in the oil. The temperature of the cold water before it enters the injector or feed water heater should also be taken. Great care should be exercised that all scales, steam gauges, etc., are correct, and that there are no leaks about the pumps, pipes or boiler, by which any water may escape without being evaporated. Steam leaks are not material except as misrepresenting the consumption of the engine. The temperature of escaping gases may be taken by inserting a brass or copper pipe, with closed end in the smoke connection where it leaves the boiler. This cup, which should reach the centre of the escaping gases, may be filled with oil and a high registering thermometer placed in it. Previous to the hour for starting, say at 6.30 o'clock, steam should be up to the working pressure and the tubes and all surfaces and flues should be swept clean. The ash pit should be cleaned and the first charge of kindling and coal, or the fuel to be used, should be weighed, every man should be at his post, those who are to note the various readings provided with ruled forms for recording the gross, tare and net weights of fuel and water, and others for the pressure of steam, temperatures of feed-water and escaping gases, which should be noted every quarter hour. At the hour for starting the height of the water in the boiler should be marked on the gauge glass, so that it may be brought to the same place at the close of the test, and the fire should be drawn quickly and replaced with the weighed kindlings and fuel, (wood kindlings are generally taken at $\frac{1}{10}$ the value of coal by weight). The working of the boiler may be conducted as usual in every way, the stoking should be done carefully, so that no waste may occur through dead spots or holes in the fire, or uneven distribution of fuel. If the fire is too thick, some of the gas will pass off unconsumed for want of sufficient air, and if the fire be too thin, too much air will be admitted. The draught or air supply should be regulated by the ash pit doors or registers, and an even fire and steady pressure of steam maintained throughout the test. If work is to be suspended at mid-day, or any time during the test, the drafts may be closed, the fire banked, and an attendant left in charge who will regulate the fire if necessary, so as to keep the pressure constant. At the close of the test the water should be brought to the same level in the boiler as at the beginning and the fire withdrawn and deadened quickly with water. The remaining coal should be weighed and deducted from the quantity charged to the boiler, and the ashes may also be weighed. The net weights of coal and water may then be summed up and the result of the test ascertained and recorded in the following manner:—

Test of boiler at	
day of	18
Kind of boiler	
Dimensions	
No tubes	
Size of fire-box	
Grate surface	sq. ft.
Heating surface	do
Height of chimney	
Size of chimney	
Duration of test	hours
Kind of fuel	
Boiler pressure (by gauge)	lbs.
Temperature of feed-water entering boiler	degrees Far.
Temperature of feed-water entering pump or injector	degrees Far.
Temperature of escaping gases	degrees Far.
Total fuel consumed	lbs.
Percentage of moisture in fuel	per cent.
Equivalent dry fuel	lbs.
Total weight of ash	lbs.
Equivalent combustible	lbs.
Total water evaporated	lbs.
Water evaporated per hour	lbs.
Water evaporated per pound of dry fuel	lbs.

Water evaporated per pound of dry fuel from and at 212° lbs.
 Water evaporated per pound of combustible from and at 212° lbs.
 Horse power developed.

The above particulars are determined in the following manner:—The pressure of steam and temperature of feed-water and gases are taken from the average readings of the same.

The total quantities of fuel, ash and water are taken from the net summing of log, great care being taken that no error is made. The percentage of moisture in fuel is determined by drying a sample of the fuel for 24 hours and getting the difference between the wet and dry weights, which difference is multiplied by 100 and divided by the weight of sample before drying.

The equivalent dry fuel is found by multiplying the total quantity of fuel by the percentage of moisture and dividing by 100, which is deducted from the total quantity of fuel.

The equivalent combustible is found by deducting the total amount of ash from the total quantity of fuel.

The water evaporated per hour is the total quantity of water divided by the number of hours duration of test.

The water evaporated per pound of dry fuel is the total quantity of water divided by the total quantity of dry fuel.

The water evaporated per pound of fuel from and at 212° is found by multiplying the water evaporated per pound by the total heat, or heat units, of one pound of steam at the average pressure, less the total heat of one pound of feed water at the average temperature of feed water before entering the pump or injector, and dividing the product by 966, which is the total heat in units, of one pound of steam at 212°.

The horse power is determined by deducting the total heat units of one pound of feed water at the average temperature before entering pump or injector, from the total heat units of one pound of steam at the average pressure, and multiplying the product by the quantity of water evaporated per hour and dividing by 1110.343 (which are the heat units required to raise one pound of water from 100° and evaporate it at 70 lbs. pressure), the quotient should be divided by 30, which will give the horse power according to the American standard. The following is an example of this method of finding the horse power:—

Total quantity of water evaporated=2,000 lbs.
 Steam pressure (by gauge) 60 lbs.
 Temperature of feed water before entering pump, 40°
 Total heat of 1 lb. of steam at 60 lbs. pressure=1175.710 B. T. U.
 Total heat of 1 lb. of feed water at 60 lbs. pressure 40° =8 B. T. U.
 $1175.710 - 8 \times 2,000 \div 1110.343 + 216.33 \div 30 = 70$ H. P.

Example of finding the equivalent evaporation from and at 212°.

Water evaporated per lb. of fuel, 10 lbs.
 Average pressure by gauge 60 lbs.
 " temperature of feed water, 40°
 Total heat of one lb. of steam at 60 lbs. pressure, 1175.710 heat units.
 Total heat of one lb. of feed water at 40°, 8. heat units.

Example:

$$10 \times 1175.710 - 8 \div 966 = 12.08 \text{ lbs}$$

In comparing fuels as well as in comparing the efficiency of boilers, the quantity of water evaporated per pound of fuel from and at 212° should always be used. The actual quantity of water evaporated per pound of fuel will differ with variations of temperature of the feed-water entering the boiler, and also with the steam pressure or temperature at which the steam leaves the boiler, but the quantity evaporated per pound of fuel from and at 212° allows for these variations and gives a true comparison of the value of fuel if the efficiency of the generator is constant, or of the efficiency of the generator if the calorific value of the fuel is known. The temperature of saturated or dry steam always corresponds with the pressure, but if from any cause the steam be not dry, it will carry away less heat in proportion to weight, or, if the steam be superheated by contact of the products of combustion with the steam surface of the boiler, it will carry away more heat. In either case the result of the test will be vitiated unless the quality of the steam be ascertained and accounted for. This is usually done by means of a calorimeter, one of the best of which, known as the "Barrus Calorimeter," was designed by Mr. Geo. H. Barrus, of Boston. No attempt has been made to ascertain or account for the quality of steam in the simple test given, because it would complicate the work, it is intended that a professional test of the boiler should include this important item, and, if the boiler is found to be abnormal in this respect, the expert should either give directions for the removal of the cause, or provide a formula for the correction of the error due to wet or superheated steam in future tests.

The following table will be found useful in ascertaining the equivalent rates of evaporation, horse power, etc.:—

STEAM TABLE.	125	352.8	1189.555	FEED WATER.	200	168.7
	120	350.	1188.695		190	158.6
	115	347.1	1187.809		180	148.5
	110	344.1	1186.899		170	138.4
	105	341.	1185.961		160	128.3
	100	337.8	1184.992		150	118.3
	95	334.5	1183.986		140	108.2
	90	331.1	1182.945		130	98.1
	85	327.6	1181.866		120	88.1
	80	323.9	1180.741		110	78
	75	320.	1179.569		100	68
	70	316.	1178.343		90	58
	65	311.8	1177.060		80	48.1
	60	307.4	1175.710		70	38.1
	55	302.7	1174.286		60	28.1
	50	297.8	1172.779		50	18.1
	45	292.5	1171.176		40	8.06
	40	286.9	1169.460		32	0
Pressure of steam by gauge.	Temperature.		Total heat of evaporation above 30° in heat units.	Temperature of feed water.		Tot. heat above 32° in heat units.

Remarkable Increase in the Value of Platinum.—Five years ago platinum was seldom used in the United States, being employed only in the evaporating stills for the concentration of sulphuric acid and in the manufacture of jewellery. It was then \$3 and \$5 an ounce, six months ago it had increased to \$14, and it has now gone up to \$20 an ounce, which is only a few cents less than the gold quotation.

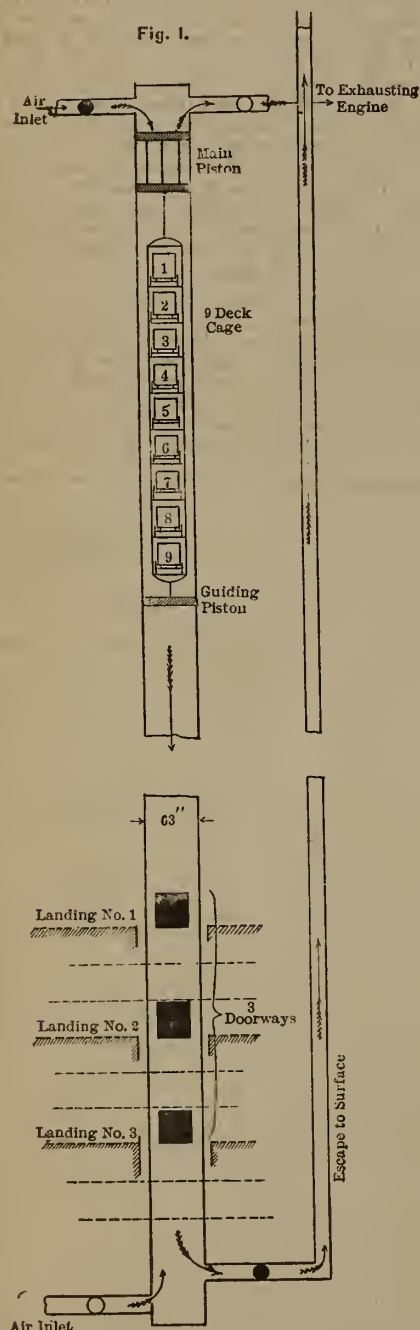
Uses of Asbestos.—Asbestos in its various forms is a very useful substance, and can be employed very handily in many ways at the lecture table and in the laboratory, says Professor Markoe. Shredded or carded asbestos will serve as an excellent filtering material, used just the same as paper pulp. Asbestos twine is used in binding together parts of apparatus exposed to fire and strong acids. The professor often prevented a crack in the neck of a retort or flask from spreading by binding it with asbestos yarn or twine soaked in solution of sodium silicate, and then treated with a solution of calcium chloride, a perfectly insoluble cement being thus formed. Asbestos wool mixed with solution of silicate of sodium makes a fire-proof cement of great strength, also serves to mend cracks in stoneware. It can be made insoluble by subsequent treatment with calcium chloride, silicate of calcium being formed. Asbestos paper and card can be obtained of all degrees of thickness, and can be well employed as substitutes for wire gauze and the sand bath in small operations involving the heating of glass vessels. Asbestos paper and silicate of sodium are very useful for mending cracks in glass apparatus.

Pneumatic Hoisting.

By H. A. WHEELER, ST. LOUIS, MO.

[Transactions of the American Institute of Mining Engineers.]

The great depths attained by some of the older mines, and the much greater depth at which they will have to be worked in the not distant future, strongly emphasize the imperfect and inadequate character of our present hoisting practice. The depth of 3,000 feet having been exceeded at several places, and 4,000 feet almost reached at Mons, Belgium, we are brought to face the unpleasant fact that in these instances the mere dead weight of the rope itself is not only the principal part of the load on the winding engine, but that the limit is being rapidly approached at which the ordinary cylindrical rope cannot safely be used, lest it break by reason of its own weight.*



pean engineers have reduced the consumption of fuel by different systems of counterbalancing, while by the use of tapered ropes they have very much extended the practical working length of the rope before it will break of its own weight. Theoretically the tapered rope has no such limit, but practically, as used at present, it has its limit, though very much exceeding that of a cylindrical rope.

In attempting to replace the rope system of hoisting, on account of the disadvantages alluded to, the French engineers have tried the endless chain system of Saint Jacques at Montlucon, the Mehnman engine at Anzin and Rohnchamp, and the Blanchet pneumatic system at Epinac. The two former systems were found in practice to be too complicated, too expensive in repairs, and too dangerous, and have been abandoned; and while the pneumatic system was not a success, the failure to find workable coal and the consequent incompleteness of the plant explain that result and leave this most promising of the new systems still entitled to consideration.

The pneumatic system is entirely free from the above mentioned defects of ropes, since it is not subject to the influence of depth, and gives no initial heavy dead load due to the weight of the rope, being in this respect a theoretically perfect medium for "pulling" mineral out of the deepest possible mine. These advantages seem so great, in view of the rapidly increasing depth of mines,† that a sketch of the practical application of this system at Epinac, France, which the writer had an opportunity of visiting last summer, is herewith given. A complete description giving the details of the construction, calculations, and operation of the plant, with illustrations, will be found in the *Annales des Mines* of September and October, 1878, Paris.

THE BLANCHET PNEUMATIC SYSTEM.

The pneumatic system, as installed at the Hottinguer shaft of Epinac Colliery, Saone-et-Loire, France, was designed by M. Zulma Blanchet, who was the managing director of a large company operating several mines and a local coal railroad at Epinac, in central France. The first suggestion for thus using air was made in 1852 by M. Gruner, the director of the School of Mines of St. Etienne, and a model constructed on this principle was exhibited by M. Cave at the first Paris Exposition; but the credit of first putting the system into practical operation is due to M. Blanchet. The vertical Hottinguer shaft, started in 1863, had reached a depth of 2,133 feet in 1871, and was to be sunk to a depth of at least 3,300 feet; but unfortunately for the company and the entire mining world, no workable coal has thus far been met with, so that instead of developing a large mine to raise over 700 tons a day, it still remains (1889) a prospect, while the plans of M. Blanchet were not satisfactorily completed on account of the great expense of installation and the discouraging nature of the explorations. So, although a thorough test of the system was not made, according to M. Blanchet's more advanced ideas, yet sufficient experience was gained to furnish evidence as to the practical desirability of this novel system of extraction.

M. Blanchet's plan was to have one or two continuous air-tight sheet-iron cylinders or large tubes extending from the bottom to the top of the shaft. See sketch. Within the cylinder moved a piston, to which was hung a cage with as many decks as desired, nine decks being used at Epinac, while suitable air-tight doors open out at each level for allowing the decking of the cars. It was operated by exhausting the air from above the piston, and as the lower side was open to the atmosphere, the piston was raised by the difference in pressure of the atmosphere and the vacuum produced by the air-pump. For lowering, it was merely necessary to allow the air to re-enter above the piston by a throttle-valve while the speed could also be regulated by throttling the escape of the expelled air from below the piston. It is obvious that, neglecting the friction of the piston, any lifting capacity desired can be obtained, for a given vacuum, by merely increasing the diameter of the tube, while the speed of hoisting will depend on the capacity (size of speed) of the exhausting engine to maintain this vacuum.

Besides its legitimate function as a hoisting device, M. Blanchet was enthusiastic about the additional services it would perform in cooling and ventilating the mine through the introduction at each trip of the volume of air represented by the depth of the shaft and the diameter of the cylinder. He also proposed to make a special use of the system in fiery coal mines by closing all openings of the mine, and then by working the exhausting engine, to aid

the disengagement of the fire-damp which is supposed to take place freely during a barometer depression. He urged that on subsequently re-opening the mine and sweeping out the gas with the regular ventilating appliances, the mine would be made much safer.

EXPERIMENTAL PLANT.

Before the erection of the final plant, an experimental one was built consisting of a tube $6\frac{1}{2}$ inches in diameter by 95 feet high connected with a 12 horse-power vacuum pump. With a vacuum of 18 to 19 $\frac{3}{4}$ inches, a velocity of 1,181 feet per minute was attained in lifting 264 pounds, which is equivalent to any efficiency of about 80 per cent.† of the engine power. The friction of the piston in the tube amounted to 10 per cent.

The load of 264 pounds was made up as follows:—

	Pounds.	Per cent.	Per cent.
Dead Load { Piston.....	31.9	= 12.1	
	Cage.....	37.4	= 14.2
	Cars.....	7.9	= 3.0
Live Load, or Coal.....	186.8	= 70.7	
Total.....	264.0	= 100.0	100.0

From these very encouraging figures the following estimate was made for the final plant, in which the tube was to be 63 inches diameter:—

Piston.....	2.25 gross tons =	18.75 per cent.	
Cage.....	3.00 " =	25.00 " "	
9 cars, at 0.25	2.25 " =	18.75 " "	
Coal.....	4.50 " =	37.50 " "	
Total....	12.00 gross tons =	100.00 per cent.	

The time required for the round trip at the greatest contemplated speed, 3,280 feet, was estimated at 7 minutes, as follows:—

	Min. utes.	Sec. onds.
To load at bottom (3 deckings).....	0	30
To hoist.....	3	00
Discharging at surface (3 deckings).....	0	30
Descent.....	3	00
Total time for round trip.....	7	00

If this speed could be maintained, it would give a capacity of 33 $\frac{3}{4}$ gross tons per hour from a depth of 3280 feet with a single tube. With two tubes, the capacity would not alone be doubled, but a great advantage would be gained by operating them together, the exhaust engines alternately exhausting and discharging from one into the other, practically counterbalancing one piston with its cage, cars, etc., against the other. Accordingly, M. Blanchet designed the Epinac plant, to be operated with two tubes.

FINAL PLANT.

The tube or cylinder was made of sheet iron, 0.27 to 0.31 inch thick, in circular sections $4\frac{1}{2}$ feet in length, having butt joints for the vertical seams, secured by countersunk rivets. The sections were bolted to one another by flanges made of angle iron, using rubber packing to keep the joints tight.

The alignment of the tube was preserved and its weight sustained by suitably connecting it to the shaft timbers, so that the tube stood vertical, within the enclosing special timbering, without bearing any excessive weights on its base.

Cast-iron doors, opening outward, were placed at the landings, it being arranged at Epinac to load three decks at once, in order not to lose too much time in handling the nine cars, as each deck only accommodated one car.

The chairs or catches for sustaining the cage at the landings passed through stuffing boxes, to prevent any leakage of air, and were operated in the usual manner.

The total weight of a single tube, 63 inches diameter and 1,979 feet high, with all its doors, valves, chairs, hanging rods, bolts, etc., was estimated at 342 gross tons, of which the tube alone amounted to 245 $\frac{1}{2}$ gross tons.

The train, or moving members, consisted of an upper double piston, to which was hung the cage with its nine decks, and a lower or guiding piston, the whole having a vertical length of about 52 feet. The pistons were packed with leather, backed by springs, and the whole train was made as light as possible by using steel in its construction.

For indicating the position of the piston, push, or touch buttons were located along the tubes, which, on being touched by the piston in moving past them, made an electrical connection indicated on a series of tell-tale dials in the engine room. Barometers and second chronometers were also used as additional safeguards for indicating the position of the cage. The latter did so in a rough way, by the time usually required to make a trip, while the former were connected with the tube about

† A subsequent statement gives 18 horse-power instead of 12, as above, for the vacuum pump; and only 50 per cent. instead of 70.7 per cent. of the gross load as live or coal load, while the gross efficiency is given as 40 per cent.; as the live load is only half of the gross load, 20 per cent. is the net or coal raising efficiency for the system, beginning with the vacuum pump as the source of power or 100 per cent.

While we Americans are not apt to borrow trouble by anticipating the problems of the future involved in the latter feature, the first named defect of the present system of hoisting deserves our immediate attention, because it calls for an excessive consumption of power and consequent increased cost for fuel and plant. The Euro-

* Taking the weight of a cast-steel hoisting rope of $1\frac{1}{4}$ inches diameter at 2 pounds per running foot, and its breaking strength at 84,000 pounds, it should, theoretically, sustain itself until 42,000 feet long before breaking from its own weight. But taking the usual factor of safety of 7, then the safe working length of such a rope would be only 6,000 feet. If a weight of 3 tons is now hung to the rope, which is equivalent to that of a cage of moderate capacity with its loaded cars, the maximum length at which such a rope could be used, with the factor of safety of 7, is 3,000 feet or

$$2 \times 6000 = \frac{84,000}{7} \therefore x = 3000 \text{ feet.}$$

† To appreciate the rapid rate at which the mines in some of our older camps are growing deeper, it may be well to mention that the Comstock lode, of Nevada, was first worked in 1850, and had reached a depth of 3250 feet by 1886, when work was abandoned in the lower levels. The Lake Superior copper district, which has several very deep mines, was first worked in 1884, and the Tamarack Mine, though only started in 1882, has already attained the depth of 2820 feet, and is sinking two more shafts that are expected to cut the lode at a depth of 3700 feet within four years (a rate of over 1000 feet per year has been attained at this mine in shaft sinking). A new mine, called the Tamarack Junior, is likely to reach a depth of over 4000 feet within the next ten years, if a chute of copper is found that has thus far been very persistent.

every 100 yards, and so showed the progressive position of the cage. Suitable valves at the landings, connecting with the atmosphere and the exhaust engine, permitted the safe and easy landing of the cage, on their being operated by the lander, while safety valves were used at the top and bottom of the tube to check slowly the velocity of the cage, and prevent the piston from knocking out the tube heads, in case of inattention on the part of the lander.

After seven months spent in erection, a single tube, 63 inches diameter was ready for trial in 1876, it having been decided to first build only a single tube, and to subsequently add a second, making it a duplex plant, if found desirable.

A temporary exhaust engine was improvised from a former hoisting engine of 64 horse-power, which raised a gross weight of 6 tons in 20 minutes, with a vacuum of 9.45 to 9.85 inches of mercury, from a depth of 1,970 feet.

The piston was lubricated with very dilute soap-water, containing 0.27 per cent. soap, and 0.1 per cent. oil, and from 11 to 55 pounds were used per trip, depending on the dryness of the atmosphere.

Of the 64 horse-power developed by the exhaust engine, 75 per cent. was utilized during the period of ascent, but as no useful work is accomplished during the preliminary exhausting of the tube, in producing the vacuum by which the train is finally started, the average efficiency was 56 per cent.; and as 50 per cent. of the gross load was coal or net weight, this gives a net efficiency of 28 per cent. of the engine power, with a single non counterbalancing tube.

The final exhaust engine is a duplex, direct, horizontal engine of 739 horse-power, with 46 x 46 inches steam cylinders, 46 x 113½ inches air cylinders, and when making 23½ revolutions per minute, with 75 pounds steam pressure, cutting off at ½ stroke, has a calculated efficiency of 70 per cent. With this powerful engine the time required to make a round trip, going a distance of 1979 feet, was as follows:—

	Min-utes.	Sec-onds.
For the ascent.....	2	30
For the descent.....	6	00
For making the landings.....	3	00
Total time for round trip.....	11	30

The load raised was as follows:—

Weight of pistons, cage, etc	6,600 lbs.	} = 54 per cent.
Weight of 9 cars @ 550 lbs.....	4,950 lbs.	
Weight of 9 car loads coal @ 1,100 lbs.....	9,900 lbs.	} = 46 per cent.
	<hr/>	
Total... ..	21,450 lbs.	= 100 per cent.

The live load or coal amounts to 46 per cent. of the total weight raised.

With the conditions for hoisting at the other shafts at Epinac, using tapered manilla ropes, winding on reels, with one cage counterbalancing the other cage, M. Blanchet makes comparisons at different depths of rope and single tube pneumatic hoisting as shown in table on following page.

These figures are favourable to the pneumatic system, as with only a single tube the useful efficiency is greater in all cases, and decreases at a less rapid rate than with rope hoisting for increasing depth, while the coal consumed per ton of coal raised is in consequence very much less in the pneumatic than with the cable system of hoisting. With two tubes, where the dead loads of the pistons, cage, cars etc. (amounting to 54 per cent. of the total load), counterbalance one another, the efficiency would be correspondingly greater, and *very much higher* than in cable hoisting. This feature was unfortunately never developed at Epinac, as the second tube was not erected, and hence the minimum working cost of the system was not attained.

ADVANTAGES OF THE PNEUMATIC SYSTEM.

M. Blanchet sums up the advantages of the pneumatic system of hoisting as follows:

1. It permits the working of mines at all depths.
2. It gives, with a single tube, a higher efficiency than cables, which increases as the depth increases; with two tubes, the efficiency will be still greater.
3. It does away with ropes, and is therefore more economical.
4. It assists in the ventilation of the mine, with the lowering of the temperature resulting therefrom.
5. It permits, while the miners are absent, converting of the entire mine into a pneumatic receiver, and by the creation of an artificial barometric depression, facilitates the removal of the escaping fire-damp and so make the mine safer.
6. It leaves the shaft readily accessible for examination, repairs, and sinking, without interfering with the hoisting.
7. It removes the danger of accidents through the breaking of cables.
8. It gives greater security to the miners in ascending and descending.
9. It not only permits the lowering of the men, timber, filling, etc., without the expenditure of any power,

but utilizes the work produced by the descending train in imparting a higher pressure to the air escaping from the bottom of the tube.

The only disadvantage, in M. Blanchet's opinion, is the greater cost of installation, which in his first estimate for the Hottinguer shaft he places at about 20 per cent. greater than that of the rope hoisting.

The statements made thus far concerning the Epinac plant have been quoted from the several brochures* by M. Blanchet, and as he was an enthusiastic advocate of the pneumatic system, his claims in its favour demand investigation.

CRITICISM OF THE PNEUMATIC SYSTEM.

I. The statement that the pneumatic system has no limit in depth is certainly true theoretically, and there seems to be no practical difficulty in applying it to the greatest depth attainable. This is the salient and vital idea of the system, which would seem to entitle it to precedence over ropes after a certain depth has been attained.

II. That the efficiency of the pneumatic system is greater than that of cables must necessarily follow *if the depth is very great and the ropes are not counterbalanced*, as the principal part of the load is then the cable; but if the ropes are counterbalanced, especially if by an under rope, then the pneumatic system cannot be equal in efficiency to cables, if both systems are operated on the double or duplex plan, so as to counterbalance the dead weight of the cage, cars, etc. For if we start with equal amounts of energy in the delivery of the steam cylinders of the exhausting and winding engines, in the one case this must overcome the appreciable friction of the stuffing box, piston and valves of the vacuum cylinder, suffer the decided waste of energy due to the clearance of the valves, ports, etc., overcome the slight frictional resistance of the air travelling through the connecting pipes, valves, and tubes, do the useless and uncertain work of removing the air brought in by leakage at joints, valves, stuffing boxes and doorways of the tube, and overcome the friction of the pistons in the tube

Depth in Feet.	Cable Hoisting.			Pneumatic Hoisting.			Coal Consumed per ton Coal Extracted.	
	Horse Power.			Horse Power.				
	Expended.	Utilized.	Efficiency Per Cent.	Expended.	Utilized.	Efficiency Per Cent.	Cables.	Pneumatic.
820	225	90	40	800	360	44	55 lbs.	16'5 lbs.
1,640	500	180	36	862	360	42	110 lbs.	33'0 lbs.
3,280	800	224	28	985	360	36	220 lbs.	66'0 lbs.

before it begins to be usefully expended in raising load. In the other case a direct first motion hoisting engine must overcome the friction of the shafts of the drum and sheaves (well lubricated), expend the small amount of energy required to bend the rope about the drum and sheaves, and overcome the slight friction of the cage in its guides before it can be utilized in useful work. While these losses of energy can be expressed in an equation, the coefficients by which they should be modified have not all been satisfactorily determined. M. Blanchet puts the losses in the vacuum pump alone at 25 per cent. (and the makers say 30 per cent.), while the friction loss of the piston in the tube was 10 per cent. in the experimental tube, though undoubtedly it is much less in the large tube when well lubricated.

The entire loss of energy and rope practice usually range from 10 to 20 per cent. Leaving out of consideration the greater efficiency of a direct-acting hoisting-engine over a vacuum pump, and assuming that the friction of the air through the pipes, valves, and large tube do not consume more power than that required to bend the rope over the sheaves and drum, we still have the inappreciable friction of an ordinary cage in its vertical guides, which is almost *nil* with proper alignment as against the decided and unavoidable friction of the air-tight piston in the tube. So that while M. Blanchet's figures speak strongly for the greater efficiency of a single tube air system, when compared with a duplex cable hoist they will not bear investigation. His own broad and sanguine statement that the efficiency of the vacuum pump plant will be as great as 70 per cent. at once gives an effective or coal raising efficiency of only 32.2 per cent., when it is remembered that only 21.450 of the load raised is coal, whereas he quotes about 42 per cent. for the pneumatic system and 36 per cent. for the cable system. As he does not give the details by which he obtained his figures, further errors cannot be specifically pointed out.

The actual fuel consumption, when the pneumatic plant was operated at Epinac, amounted to 10 tons per day in raising from 10 to 50 tons of coal; but as the fuel was inferior coal, and as hoisting in carrying on prospecting is very irregular as well as petty in amount, this excessive

consumption cannot fairly be charged against the system, though it certainly does not encourage the hope of a marked economy in fuel.

III. That there will be no expenditure for ropes in the pneumatic system follows necessarily, together with the avoidance of their renewal every six to eighteen months. But with proper size of drums and sheaves, feed screws to prevent side cutting of the rope as it winds on the drum where the engine is close to the shaft, and springs at the capping, a first-class steel rope should, as it does in the best English practice, last from two to five years, or raise from 200,000 to 600,000 tons of ore or coal before it is worn out. But while the cables are dispensed with, the new feature is introduced of a thin wrought-iron cylinder, held by countersunk rivets, which deteriorates every time that the snugly-fitting piston passes through it. The piston packings, of which there are three sets, need frequent removal, as they must be kept tight to avoid leakage; while there is quite an appreciable daily outlay for lubricating the tube, as from ten to fifty-five pounds of 3 per cent. solution is used per trip. If the shaft is not so wet as to prevent the decay of the timber, the heavy timbering system required to sustain the tube will also need renewal, at no small cost, while the expense of maintaining a very large, fast running, expanding exhausting engine, with all its valves, will be greater than that of an equivalent direct hoisting engine. Unfortunately the Epinac plant was not operated long enough to develop these maintenance expenses, but it is quite evident that the repairs and renewals of a cable plant will finally be decidedly less than those of the pneumatic system.

IV. The aid to ventilation is of some advantage, particularly in metal mining, where only natural ventilation is so largely depended on. With a tube 3,000 feet long and 63 inches diameter, there would be delivered into the workings during a round trip of twelve minutes, a volume of 5,425 cubic feet of air per minute, which *positive acquisition* would be no insignificant item; and the deeper the shaft the greater would be the volume of air

expelled at each trip. In coal practice, however, this amount of air would be entirely too small to be entitled to much consideration.

V. The novel application of the exhausting engines, through the medium of the tube, to the production of an artificial barometric depression throughout a tightly sealed mine, is at least attractive to miners troubled with gas, and undoubtedly would be advantageous in some cases. Where the gas is generated in the goaf or old rooms, and consequently its escape into the workings is facilitated by the lowering of the atmospheric pressure, a benefit will be derived in thus frequently forestalling nature and keeping the air safe. But where the gas is being given off by the slow continuous escape under great pressure from the coal (which is the case most frequently, though, fortunately, is usually not so dangerous), or where the gas results from blowers due to falls in the roof or breaks in the floor (the most dangerous instances), no good will result in thus turning the mine into a vacuum chamber. It is also obvious that in very extensive workings the time required to produce an appreciable lowering of the pressure of such a huge volume of air would exceed the period of an off-shift, while no repairing or other off-shift work could go on, on account of the danger of gas, with the ventilation at a standstill. Hence only Sundays or holidays could be used for this purpose during the regular working of the mine, which is not frequent enough to make it perfectly safe. If the proof is badly broken, especially if the breaks connect with the surface, the application will be useless, while in many cases it will be difficult to prevent excessive leakage into the mine at the shaft entrances. This novel feature, therefore, is capable of only a few applications in the gas troubled mines, and even then may not be valuable on account of the magnitude of the workings. Finally, in any mine troubled with gas from any source, the regular ventilating facilities should be on so large a scale that the gas is so diluted as to preclude any danger of explosion, except from sudden large blowers.

VI. The ease of repair of the shaft is greater in the pneumatic system, since it is possible from the capstan engine to make any inspections or repairs in the shaft,

short of renewing the tube, without in the least interfering with the hoisting.

VII. While accidents due to cable breakage disappear, a more serious danger arises in the much greater vigilance required on the part of the lander in keeping trace of the noiseless invisible cage, as the tell-tales, though ingenious, are hardly satisfactory. The unreliability of electric sounders or tell-tales in damp shafts are well-known, while barometers are very crude aids in making a landing, where the margin for dropping the cage on the chains is so small. Although a large safety-valve is placed at the top and bottom of the tube to slowly cushion the cage and prevent accidents arising from carelessness in over hoisting, it is evident that the momentum of a ten ton train will demolish any such device should it pass the terminal landing with its speed unchecked in spite of any reasonable margin for over-hoisting. Furthermore, while the breakage of the ropes has by no means ceased to occur, good devices can be used, at least on vertical shafts, that act promptly and arrests the cage in case the rope breaks, if *reasonable attention* is bestowed upon keeping the safety-catches in good condition.

VIII. That the pneumatic system will be more exempt from accident than the cable system seems hardly probable in view of the previously mentioned want of a reliable, continuous system of recording the positions of the cage in the tube. Overwinding or carelessness on the part of the landers or engineers, quite a frequent cause of accidents at present, seems likely to become even more dangerous in the pneumatic system. The trouble arising from the distortion of the shaft with consequent jamming of the cage in swelling or heaving ground, would be exaggerated in the pneumatic system, with its train fifty-two feet long; for while the tube stands free by itself away from the shaft lining, the displaced timbers supporting it would so distort and throw it out of line as to readily cause the jamming or sticking of the train in the tube.

The Epinac was not operated sufficiently long to develop reliable figures as to accidents with the pneumatic system. It created, however, a favorable opinion among the miners as being at least a very pleasant way of being raised and lowered.

IX. The want of merit in the last claim over rope hoisting, when properly operated, is self evident, and needs no comment.

How well these claims were realized at Epinac is most quickly appreciated upon finding a winding engine busy in the same shaft in carrying on the exploratory work, while the pneumatic plant along side of it, with one tube and its massive vacuum engine in complete running order, has been idle for several years, as it was too expensive in operation.

One item of excessive cost in the pneumatic system, to which M. Blanchet makes no allusion, is the greater labor expense per ton hoisted. If worked at full speed, the Epinac plant could raise about 250 tons in ten hours.

The force required was as follows: four firemen, one engineer, one runner, two landers, four cagers, one machinist; total, thirteen men, or $\frac{2.50}{13}$ — 20 tons per man in the hoisting department.

Winding engines of even less power, hoisting from as great a depth, frequently raise from 1,000 to 1,500 tons in ten hours, with a force no greater than two more cagers, or hoisting from 60 to 100 tons per man, making the labor charge for hoisting $\frac{1}{3}$ to $\frac{1}{2}$ of that of the pneumatic system.

THE COST OF THE PNEUMATIC SYSTEM.

Before alluding to the outlay involved in the Hottinguer shaft, it is necessary to deal with the great difference between French and American practice in plant expenditure.

The French mining engineers, with usually an abundance of cheap money at their disposal, are characterized by their very heavy outlays in permanent plant. They make everything to last, and also, be it said to their credit, design, with regard to appearances and artistic effect. Hence there is a large outlay at the Hottinguer shaft for a masonry lining for the entire shaft, and a very large, substantial, brick shaft house, with a high brick chimney for the boilers which would be regarded as extravagant in America. Moreover, in executing their plans, they have recourse to a staff of trained engineers that is as yet far in advance of our so-called "practical" way of doing the same work. For these reasons, there has been a lavish outlay at the Hottinguer shaft, that is, by no means, to be all charged against the pneumatic system. The statement by one of the directors, that the experiment had cost them \$500,000, refers to the entire outlay at the shaft. The expense of the pneumatic system proper, is given to me by M. Nagerode, the present superintendent, as follows:

Tube and connections.....	\$ 70,000
Erection, including winch engine, etc.....	74,000
Exhausting engine (or vacuum pump).....	42,000
Total.....	\$186,000

These figures show that the erection of the tube cost more than the tube itself, and that the tube (with its con-

nection) cost about \$35 per running foot. As there are 775 pounds metal per linear foot this shows a factory cost of the tube of about $\frac{1}{4}$ cents per pound, a figure that is about half what such work would usually cost in this country, when it is remembered that 72 per cent. of the metal required makes up the countersunk rivetted main tube. It is probably safe to say, that such a tube erected complete in this country would cost over \$100 per linear foot. This does not include the vacuum engine, boilers, housing, and the primary cost of first sinking the shaft. So that a pneumatic plant, complete, would call for at least double the capital of a rope hoisting plant of equivalent grade, and when finished, aside from probably much greater operating expenses (fuel and repairs), would not have a fifth of the capacity of the cable system, as reckoned on the actual figures of the Epinac plant.

SUMMARY OF THE PNEUMATIC SYSTEM.

With a so much heavier investment of capital, with such a very small capacity compared with winding engines of equal power, and with the probability of a much greater daily operating expense, it is needless to say that the pneumatic system, as thus far developed, can not compete at all with the rope system of hoisting in spite of the theoretical and the few practical advantages it possesses over the cable system.

It is, therefore, necessary to look deeper into our American winding practice, to search for opportunities for improvements, so that the requirements for increased depth in the not distant future may be met.

CONSIDERATIONS FOR THE FUTURE.

Theory indicates that tapered ropes have no limit in depth, and consequently, that by tapering and counterbalancing, ropes may be used in the deepest mines; but practically, in using flat ropes with reels as they are now made, there is great risk of the rope slipping off the top coils and jamming down in the narrow V space between the side of the reel and the coiled rope, with dangerous consequences, if the rope tapers to half of its extreme width. By using a guide sheave to wind the rope hard against one side of the reel, this danger may be overcome, though at the expense of more rapid wear of the rope, especially of the lacing. Flat ropes are now successfully and easily made of tapering section, and perhaps a better device can be used than the above guide roller, to avoid jamming in the reel.

Round ropes are made tapering, and if the drum is grooved to properly receive the rope, it gives no trouble in winding like the flat rope. But the American rope makers do not as yet advocate round tapering ropes on account of the difficulty of manufacturing with perfect reliability, though I understand that they are made in a satisfactory manner in Germany.

If tapered ropes are ignored on account of their greater cost and because of the objections of manufacturers, cylindrical ropes may still be used for unlimited depth by submitting to the low efficiency of the system adopted at the deepest shaft of the colliery of the "Societe des Produits," at Mons, Belgium, where a duplex, first motion engine hoists from 1000 meter (3280 feet) level to the surface. At the 1000 meter level another hoisting engine, run by compressed air supplied from the surface, hoists from the 1100 meter level, the lowest producing level at present, though the shaft is being sunk to the 1200 meter level (3937 feet). The surface engine is $27\frac{1}{2}$ by $78\frac{3}{4}$ in. with a 25 foot reel, on which wind is a flat manilla rope that tapers from 11 inches down to $6\frac{1}{2}$ inches, while the cage holds only 2 cars. The air is supplied by a duplex Dubois-Francois air compressor with $15\frac{1}{2}$ inches by 59 inches air cylinders, run at 18 revolutions per minute and furnishing air at 45 to 50 pounds pressure.

While such a system of establishing new hoisting stations with engines run by compressed air whenever the rope becomes inconveniently long (it is not counterbalanced at the above pit) can be carried on indefinitely, the outlay for plant becomes so great, the extra labor and time involved in charging cages at the intermediate levels are so expensive and the efficiency of a compressor plant is so low, with its consequent heavy fuel consumption, that the cost of installation is almost as great as in the pneumatic system, while the operating expenses are probably greater.

IMPROVEMENTS IN AMERICAN HOISTING PRACTICE.

The simple, first motion, cylindrical rope hoist, constructed with the latest improvements, possesses a limit so far beyond our present practice, when properly designed, that there need be no anxiety for a very long time to come as to its range of application. It possesses the advantage of a minimum cost of installation, the cheapest operating plant and the greatest capacity of all known systems of hoisting. Thus far, in America, our hoisting practice with few exceptions, is anything but creditable. We are behind European practice. The following suggestions show how we can still very much exceed our present limits:—

(a) *By Counterbalancing the Dead Load.*— If the system is arranged duplex, or with a double compartment shaft, the dead loads of the cage and cars counterbalance one another, and if the ropes are counterbalanced, which

is perfectly effected by an under-rope, then there remains only the work of raising the coal or live load plus the small effort necessary to overcome the friction due to the dead load (rope, cage, cars). Hence only a moderate sized engine is called for, instead of the large engines that are so frequently seen at our deep mines. Thus, in the Lake Superior copper district, where over 7000 tons of copper rock are raised per day from a depth of 1000 to 2500 feet, 60 to 75 per cent. of the engine power is wasted (except at two mines), by using single hoists in which a skip weighing from $1\frac{1}{2}$ to 3 tons, and a rope weighing $1\frac{1}{2}$ to 4 tons, are hoisted each trip in bringing up $1\frac{1}{2}$ to 2 tons of rock: while the energy of the descending 3 to 7 tons of skip and rope adds to the expense by wearing out the brakes by which the speed is kept within a safe limit. Such a grossly extravagant system of hoisting not only calls for an excessively large hoisting engine, but the fuel consumption is about three times as great as it should be to do the above amount of work.

(b) *By Using a Smaller Factor of Safety for the Rope.*— For hoisting ropes the factor of safety should be made as low as possible, consistent with uncertainty in manufacture, abuse in use, sufficient margin to permit the reduction in section due to wear, and a working strain safely below the limit of elasticity. For the larger the factor of safety used, the greater is the section of the rope for a given load. This increases the dead load due to the rope's own weight, which even if counterbalanced augments the mass to be put in motion each trip, with the consequent strain in starting.

The increased size of the rope decreases its life, as the greater the diameter, other things being equal, the more severe are the bending strains and the quicker the rope destroys itself.

Now the factor of safety usually taken for steel ropes is 7, with 5 as a minimum and up to 10 as a maximum. For standard practice I would advise 4, provided: that the diameter of the sheaves and drums be at least 100 times the diameter of the rope for slow hoisting and at least 150 times for fast hoisting; that a spring* be interposed between the cage and the rope capping, to ease the sudden strain in starting; that the rope be kept properly oiled; and that the rope be inspected daily for its entire length, for careful observation of the condition of the wires and prompt rejection of the rope when a certain number are broken.

By thus easing the bending of the rope by the use of much larger sheaves and drums than is usual in American practice; by removing the shock due to starting; and by frequent oiling to prevent corrosion, they would last at least as long as they now average in American practice. By lagging the sheave with wood; by having the engine set far enough from the shaft to avoid side thrust and consequent lateral wear of the rope at the sheave and drum (carrying the rope on wooden rollers from the sheave to the engine if necessary); and by carefully maintaining the entire hoisting plant in proper alignment, the life of the rope would probably be found to be considerably greater than at present, in spite of the much smaller factor of safety used. By thus using a factor of safety of 4, the safe working length of the $1\frac{1}{2}$ inch cast-steel rope, when sustaining a 3-ton cage load, will be increased from 3,000 feet to 7,500 feet.

By decreasing the speed of hoisting, the wear of a wire rope is diminished; but this necessitates increasing the load to maintain a given output in the same time. Aside from the other disadvantages of excessive load, the maximum size of the cars used is frequently fixed by conditions that it is not economical to change in order to use large cars. Hence the more rapid wearing out of the ropes due to high speed in deep hoisting is willingly tolerated, in order to secure the capacity and economy due to fast hoisting; and the tendency of the times is to use larger and more powerful engines in order to obtain higher speeds as the mines become deeper; so that this method of prolonging the life of a rope is not in favor at present.

(c) *By the Use of the Best Material for the Rope.*— Fiber and iron ropes are no longer used in deep hoisting in American practice, but the term "steel" covers a very broad range of material used in our present practice. The very soft steel ropes certainly possess the greatest flexibility, but they are deficient in strength, as the material has a breaking strength of about only 60,000 pounds to the square inch. The best grade of plough steel, on the contrary, has a strength of 300,000 pounds per square inch, but does not always give satisfaction as used with sheaves only 50 to 100 times the diameter of the rope, since the wires break too readily under such sharp bending. But if used with sheaves and drums 150 to preferably 200 times the diameter of the rope, and if the wires are laid at an easy pitch with the "Lang lay," no such trouble should arise; with such a high grade plough-steel rope of $1\frac{1}{2}$ inch diameter, the safe working length, using

*The intervention of an elastic connection, whether a spring or solid rubber, between the capping and the cage, need not in the least interfere with a chain connection of the rope to the cage, by which latter device the cappings have to be less frequently renewed.

a factor of safety of 4, would now be about 30,000 feet, or 12,500 with 10 as the factor of safety. While this represents the highest grade of the rope that is made to-day, we see that it is possible to hoist with perfect safety with a cylindrical rope from a depth that is vastly beyond any limit that we can reach, on account of the heat alone.

The price of aluminum has not yet permitted a thorough investigation of its use for hoisting ropes as the basis of trustworthy predictions. But the unprecedented progress made in the past year in lowering the price from \$6 to \$1.50 a pound, and the encouraging outlook for further material reduction of the present price, makes the possibility of using this metal or its alloys for hoisting ropes worthy of consideration.

The very low specific gravity of aluminum, 2.6, which is about one-third of that of steel, and its great strength, make it an ideal metal for a deep hoisting rope, where a minimum of weight and a maximum of strength are demanded. If this metal or its alloys should prove to have the requisite flexibility, toughness, and strength, to make a reliable, durable, hoisting rope, the question of deep hoisting with only cylindrical ropes is again settled beyond all cavil.

(d) *By Designing the Cage with a Minimum of Weight.*—As our mines get deeper, economy demands that we shall not only use at least 2-deck cages, but rather 3 or 4 or even 6-deckers, as used at some of the deep mines in Belgium. The prevalent objection to multiple deck cages is the time required in decking, even if the decking is carried on simultaneously from two landings or levels. To deck from more than two, or at most three, landings or levels at once, makes the stations very complicated underground and is not desirable, even should the surface plant be so arranged that there is no objection to having the ore or coal coming off on two or three levels. As our American plants are too frequently arranged, the time required to run off the loaded and run on the empty car seldom takes as little as 10 seconds, more frequently over 15 to 20, and sometimes even 30 seconds; and if this amount of time is multiplied by 4 or 6, for a 4 or 6-deck cage, it makes a serious inroad into the hoisting capacity of the plant.

But with ample facilities for accommodating both

loaded and empty cars at the landings, with sufficient help to quickly handle the cars, there is no reason why we should not at least do as well as the Belgians, who load and unload a 6-deck cage in 30 seconds, or 5 seconds per deck as their regular daily speed.

A multiple deck cage, with only one car on a deck, can be designed of steel, with a very light, and yet stiff strong frame, in which the ratio of the cage weight to that of its contents is decidedly less than with our much heavier single deck cages; so that the strain on the rope due to the weight of the cage (immaterial as to whether it is operated duplex so as to counterbalance) will be a very much less for a given carrying capacity, than with our usually strong, needlessly heavy single deck cages. Hence the rope can profit by this decrease of its load in sustaining its own weight for a still greater depth.

If two cars are run on a deck with the idea of saving the time that is supposed to result therefrom in decking, the cage weight per ton of carrying capacity will be increased over that of single decks, in consequence of the much stronger bracing required for a cage long enough to carry two cars.

The six-deck steel cage at the Sacre Madame pit weighs 3600 pounds, while the weight of the 6 loaded cars is about 9000 pounds, which gives a ratio of cage weight to carrying capacity of 1 : 2.5.

CONCLUSION.

The pneumatic system of Blanchet is practicable, quite safe, and unhampered by depth; but the installation is very much more expensive than that of the cable system (approximately twice as great), while the operating expenses are greater for labor, repairs and fuel.

The cable system can be so improved by counterbalancing as to materially decrease the present expense of hoisting, while by more careful designing and operating,

†At the "Sacre Madame" Colliery at Charleroi two men and a girl pull off the loaded cars from one side of the cage, starting it off before the cage rests on the chairs, while two stout girls push on the empty car from the other side at the rate of 5 seconds per decking. The cars weigh 600 pounds each, and hold about 880 pounds, and 350 to 400 tons of coal are raised per day. The shaft is 2625 feet deep, and 80 to 90 seconds are required to make the trip, with a 600 horse-power engine (using a flat manilla rope made of 8 strands, that tapers from 12½ inches down to 7½ inches in width.)

without materially increasing the plant outlay or the operating expenses, the present type of cylindrical ropes can be used for depths beyond what we are likely ever to attain by making the weight of the cage a minimum, by using a lower factor of safety, and by adopting the strongest rope obtainable.

The possibility of using aluminum may still further increase the range of the cylindrical rope.

When our manufacturers meet with sufficient demand to encourage them to perfect the round type of tapering rope, there will then be absolutely no limit to the range of cable hoists, although the best grades of cylindrical steel ropes will carry us, with the highest factor of safety ever used (10), to a greater depth than we will probably ever be able to attain.

A Remarkable Invention.—James Morgan, mechanical engineer, at present employed at the American Iron Works, Pittsburg, Pa., is the inventor of a remarkable labour-saving device in connection with the manufacture of steel rails and armour-plates. This invention is known as an overhead feeder, for use in blooming and finishing mills. It consists of an apparatus which can be worked by a boy with a lever, by which the ingot can be sent back and forth on the roll-table, and thence through the various grooves in the rolls without the aid of any of the skilled labourers at present employed for that purpose. A first-class mill-roller and a boy to work the levers is all that is required to operate the machine. The entire workings are controlled from a pulpit where three hydraulic levers are placed; one of these controls the blooming roll-table, the other the telegraph by which the piece is conveyed to the roll-table, attached to the finishing train of rolls, and with the third lever the entire workings of the latter train are managed. It is possible and practicable by this piece of mechanism to turn the ingots into rails without the assistance of any manual labour except that mentioned. The great labour-saving involved in this device can be imagined when it is known that many of the mills employ as high as seventy skilled labourers to do the work which Mr. Morgan claims can be done by the hydraulic levers.



VISIT OF THE IRON AND STEEL INSTITUTE. PHOTOGRAPH OF A SMALL PARTY, TAKEN ON STEAMER FILGATE DURING EXCURSION ON THE ST. LAWRENCE.



MINING NOTES.

Nova Scotia.

(From our own Correspondent.)

Pictou County.

The opening up of the Foord Pit continues satisfactorily, and from present appearances should be in working order by the New Year. 25 coke ovens, bee-hive pattern, will be ready to receive the coal, and others are to be built as the work progresses.

When the company are in a position to secure suitable engines, the "English slope" will be driven a further depth of from 1,600 to 1,800 feet, to connect with the Foord pit. This will make the slope some 3,600 feet in length.

At all the other mines work is steady. In our next issue we hope to review the season and publish returns of production and export.

It is rumoured that a new lift will be sunk this winter in the old slopes at the "Drummond." The sinking in the Scott pit is progressing favourably; the coal all the time said to be improving in quality.

A rumour has been current that the Nova Scotia Steel works at New Glasgow had been sold to English capitalists for \$600,000. We are authorized to say that while an English syndicate did have an option at somewhat larger figures, the matter is now off.

Cumberland County.

The Springhill collieries continue to maintain an average output of 2,000 tons per diem.

The output from the Joggins has increased from 150 to 300 tons, and the colliery is rapidly coming to the front as a producer. Long-wall working has now been in operation for nearly three months, and has been found highly satisfactory to employers and employed.

We are glad to learn that a movement is on foot to unite the colliery owners, managers, engineers and officials into a strong association for the interchange of knowledge and ideas. This is a move in the right direction, and if carried into effect, should result beneficially to the owners, the men, and the industry.

(From Press Committee Gold Mines' Association.)

Waverley District.

Mining will be resumed upon the Gue and Wilson property (Chebucto Mining Co.) in January, and a small mill will be erected as soon as the weather will permit of breaking ground and laying foundations.

The Lake View Company have completed a crushing of a test lot of clean quartz from the Taylor lode, which yielded $5\frac{1}{2}$ dwts. per ton, according to report. The mullock which has been going to the mill has yielded between two and three penny weights per ton, and has not contained more than from 30 to 60 per cent. of quartz.

Renfrew District.

Mining in Renfrew is almost at a standstill. The Free Claim owned by Mr. McDonell and others, is only working three men. The Empress Company are working only only a small force and employees report pay to be three months behind. It is greatly to be regretted that this district should be so dull; it was a magnificent producer years ago, and has had really no deep mining test made.

Central Rawdon.

Little or no news is reported from this once booming village. The Northrup Mining Company are doing nothing but sinking one shaft and prospecting winze, with a few men.

Killag District.

The Stuart property has been transferred to a syndicate known as the "Evans, Parker, McGuire and McKay." Mr. McKay will be the superintendent. The old mill is being rapidly renovated and will soon be crushing quartz from the rich lode cut in the swamp.

Lake Catcha.

The Oxford Co., under management of Mr. J. M. Reid, are putting in a fine air compressor and drill plant. The compressor is a duplex 10 x 16, of the latest Rand type and is a beautiful machine. Extensive changes and additions are also being made to the old

surface plant, including a new 40 horse-power boiler, new mortars for the mill, &c., &c. All the machinery will be placed and in working order before spring, and the "Oxford" will be expected to report "fine work" during next summer.

Yarmouth.

The whole plant and property of the "Huntington Reef Mining Co." has been offered for sale. This property had a newspaper boom last spring, and over \$14,000 was expended on machinery, &c.; now the owners are desirous of selling out at a fraction of the cost; the moral is beware of newspaper boomed mining properties.

Malaga District.

Reports from this district are not encouraging for the future. The mill and mine buildings of the Caledonia Company were destroyed by fire on Friday, the 12th inst., and the loss will not fall far short of \$15,000. It is reported that the company will not rebuild this season.

The Malaga Mining Company are working out the reserves in the Rabbit and other lodes, and are not opening much if any new ground. On this work the mine is paying handsome dividends, but the policy is a shortsighted one.

Mr. Ballou, of the Boston Gold Mining Company, reports that the new mill is expected to start on the 19th or 20th inst. The mine has been opened during the last nine or ten months and a considerable amount of quartz of good quality awaits crushing.

Gay's River District.

The work in the 50 stamp mill of the Coldstream Company is going rapidly ahead, and the completion of the mill is announced for February next. It is reported that all mining work has been discontinued for the present, thus following the lead of most of the other Evans-Parker mines, which have closed down this month.

Quebec.

The Jenckes Machine Co., of Sherbrooke, were, on 29th ult., granted supplementary Letters Patent, whereby the total capital stock is increased from \$75,000 to \$150,000.

About 100 men and boys are employed at the Temiscamingue Galena mine, in the Temiscamingue district. Main shaft sunk 100 feet, and cross cuts driving to the west in rich galena ores. One-half of concentrating plant in place, consisting of Blake ore-breaker, two pair rolls, revolving screens, crushers and four jigs, rotary table, furnished by the Fort Scott Foundry Co., etc. Mill driven by Corliss engine, built by Laurie & Bros., Montreal. Ingersoll compressor furnishes air for hoist and drills. Mill turns out from 6 to 10 tons concentrates per day (24 hours) according to ore. Shipments to the extent of 100 tons have been made to date, mainly to Ballbach & Son, Newark Smelting and Refining Works, Newark, N.J. Owners well pleased with result of their operations.

Mr. Obalski, Mining Inspector for the Province, has issued his annual report, which is published as usual, in conjunction with the Blue Book of the Commissioner of Crown Lands. A useful sketch of the progress of operations during the year is given. We are glad to see that the tabulated statement of individual outputs, which gave so much offence last year, has been dropped, for until sworn returns are compulsory, it is absolutely impossible to publish any correct statistics.

Most of the mines in the Eastern Townships and Ottawa valley have shut down during the holidays. In the main the season has been a prosperous one.

Ontario.

The Standard Oil and Gas Company of Ontario are seeking incorporation under the Companies' Act. Capital, \$1,000,000; divided into 10,000 shares of \$100 each. Alex. Dow, secretary, Stratford, Ont. This company has acquired some five thousand acres of land at, or near the Town of Stratford, and will commence drilling when fully organised.

The Collector of Customs at Buffalo, N.Y., recently submitted to the Treasury Department the question as to whether natural gas imported into that port from Canada is liable to duty under the tariff law. He says that the Buffalo Natural Gas and Fuel Company is engaged in laying a large eight-inch main pipe across the Niagara River for the transmission of natural gas produced in Canada to be used on this side for fuel purposes. In replying to the Collector, Assistant Secretary Spaulding says: "Under the circumstances mentioned the De-

partment concurs with you in the opinion that illuminating gas is wholly different from electricity, and that as it is a merchantable commodity which can be measured as readily as liquids and other gases, it would be liable to duty on importation. The proper rate of duty would seem to be that prescribed for unenumerated unmanufactured articles, viz., 10 p. c. ad valorem."

British Columbia.

At the mines of the Revelstoke Mining and Smelting Co., at Hot Springs, development is being pushed with vigor, and by the spring there should be a large quantity of ore ready for smelting. At the United there are at present 1,100 tons ready to ship, and about 500 tons at No. 1.

The South Fork of Quésnelle, Hydraulic Co. has completed the survey of the fifteen mile ditch for their works, and excavating has begun. The 16 or 18 inch pipe, pipe, which it is proposed to put in, will give a dead fall of 350 feet, and be the biggest work in sluicing in the Province. No returns are expected from the claim until next year, all that has been done being purely preliminary.

Mr. Hepden's claim, adjoining, also promises well, but the location of the ditch has not yet been completed. It will probably be 18 or 20 miles long, and a gang of men will be working at it all winter. Half a mile above is another good claim—at least the ground is promising, but as yet there is no prospect of water.

Placer mining continues to occupy the attention of the Chinese, one firm—the Chin Fan Co.—reporting \$8,000 or \$9,000 for this year. In the last twelve or fourteen years they have alone taken out \$50,000 or \$60,000.

Reports of good finds in the Omineca district continue to be received. Mr. George Kenny, an experienced miner who has just returned from that district, reports that a certain portion of Tom's Creek is yielding richly, some \$30,000 having been taken out this season by sixteen whites, together with Indians and Chinese.

The Black Jack quartz mill (water power), situated on William's Creek, opposite Stout's Gulch, shut down Nov. 6th for the winter. The managers have sent down to the Government test mill their concentrates to be worked by the chlorinating process. The company, at the 64-foot level of their incline shaft, drifted some twenty feet to the left and struck the surface formation of an eight-foot ledge, carrying a rich body of ore. Not being able to run their water mill in the winter the company held a meeting and decided to sink their incline shaft forty feet more to strike the ledge and will send the ore to the test mill to be worked this winter.

The Harkaway Gravel Diggings Company, in the same district (Barkerville), are hard at work drifting from their sixty-foot level under Broadway, the main street of Barkerville, and expect to strike it rich this winter.

Mr. A. Dick, Inspector of Mines, has just returned from Tumbo Island where he states the Tumbo Island Coal Company has struck a seam of coal at a depth of 328 feet. The seam is said to be a thick one but as yet it is not known what quality it is. It burns well and makes gas freely, but until a shaft has been put down, its value will not be known.

Dr. Hendryx, who is so well known in connection with the development of the Kootenay district, was the subject of a dastardly assault a few Sundays ago. It appears that Dr. Hendryx, accompanied by Mrs. Hendryx, went out of the house after dark; Mrs. Hendryx carrying a lantern and walking ahead, the doctor slightly behind. When a short distance from the house, a shot was fired, evidently at the doctor, by some one concealed in the shrubbery near an outhouse in the vicinity of the dwelling, the shot passing close to Mrs. Hendryx and striking the ground near the doctor. An alarm was at once given to the men in the mine boarding-house close by, but no trace could be found of the miscreants. A boat was sent over to Ainsworth, but unfortunately the people there were not warned; and, although the men in the boat saw a boat land near the Siwash lodges, the occupants escaped to the timber before they could be recognized. So far there is no clue as to the identity of the would-be murderers. There appear to have been two men, as two tracks were discovered on the road or trail the following morning, leading away from the spot from whence the shots were fired.

It is announced to be the intention of the New Vancouver Coal Company to complete, as rapidly as possible, the second shaft which they have for some time been

engaged in sinking. As soon as they attain the required depth, which is expected to be by January 15, they will put on an extra force of at least 150 men, for whose accommodation they contemplate putting up additional buildings. The Nanaimo *Free Press* anticipates that the Company will further reduce the price of their product to \$6, delivered in Victoria.

Mr. J. W. Jeusen, manager of the Laura Hydranic Mining Co., at Rock Creek, gives the following description of recent workings on the claims owned by his Company:—"Two years ago, work was started, and the sawmill and hydraulic plant erected. The gold all lies in alluvial deposits on the banks—80 to 90 feet high—on each side of the Creek. The hydraulic power is taken from the Creek itself, and has a pressure of 85 feet fall. This throws a five-inch stream from the nozzle of the pipe, with a force which cannot be conceived without being seen. It washes away the gravel and rends the huge rocks from their beds with a mighty power, which shakes the solid earth. This stream has been digging and tearing away the banks continuously since April 24, and the amount of pay dirt washed into the flumes and boxes would seem incredible were it estimated in cart loads. Despite the fact that a vast deal of machinery and work, including 27 new boxes and a large amount of fluming, has been put in the mine this year, it has not only paid expenses but turned out an overplus. This means that next year—when no more work of this kind, to reduce the profits, will occur—a very handsome return will be realized. Even as it is, it is claimed that the output of gold from this claim has been larger during the past season, than that of any other in this Province.

Our old friend Dr. A. C. Lawson, who has been resident in Vancouver for several months, has gone to California to fill the position of assistant Professor of Geology in the University of California, a post which his abilities and knowledge will enable him to fill with success. The hearty good wishes of his friends in Ottawa, and his more recent acquaintances on the Pacific, follow him to his new vocation.

Local papers give very graphic descriptions of the new works of the Hamilton Powder Company at Northfield, in the Wellington district, Vancouver Island. The quality of the powder turned out by this company is, as everybody knows, first class.

A Retrogressive and Obnoxious Measure. The Mining Tax Adopted

In the Quebec Legislature, 29th December:—

HON. MR. DUHAMEL moved the house into committee on a bill amending the law regarding mines.

MR. POUPORE said: I have an amendment to propose to the bill, but before doing so I wish to call the attention of the Government to the absurdity of the clause respecting prospectors. That class of persons complained of the want of security to them under the present law, but what would they think of the bill before them. Fancy a fee of \$5 for permission to explore on fifty acres of private property, and \$10 on fifty acres of public domain, which permit will only hold good for three months. This is an extraordinary condition. Take other countries where mining is carried on. No such fee is imposed. On the contrary every inducement is held out to a prospector to encourage him to go on with his onerous duty of making new finds. Without such work the most important dormant resource of our province would remain undeveloped for perhaps the next century. The bill in its entirety is a great mistake, and is certain to prevent foreign capital from coming in. The tax, after all, is small, but those who are already losing money in working mines will find it too much. Take the case of the Moulton Hill mine's iron pyrites, which is worked only for sulphur. In the shipment of the products of that mine to the United States quite recently the rate per ton realized was \$5.40, and the cost of delivering it was \$5.50, showing a loss of ten cents on each ton. Take another instance, the Bristol iron mines. The president of that company declared to me the other day that they lost \$1 on every ton of ore sold so far; but they expected eventually to be recouped. Is it not a fact that in all countries when mining was in its infancy, and after attempting to raise a revenue by the imposition of a royalty or taxes, they were obliged to abandon that system as it retarded the development of mineral resources, and only after the business became established and paying was the tax imposed. Certain mines are alluded to as making large fortunes and should contribute to the cost of administration or state. This may be true enough, but our province is too backward in its mineral development to attempt that system yet. If

we want to encourage capitalists to come in with their money we must be able to show examples of paying mines and for one mining organization that is making money you will find ten that are not. The Commissioner points out that in England in coal mines large incomes are received by private companies every year, and that he wants to prevent that system here and secure that the Government should receive that income and not private individuals. The comparison is an unfair one and not at all to the point. If the private companies alluded to in England had not invested their money to develop those mines they, in all probability, would have been undeveloped still, and hundreds of thousands of men would be unemployed. The effect of the proposed tax will retard the development of our mines, not, perhaps, on account of the tax itself, which, after all, is small, but because of the feeling of insecurity which it will create. The Commissioner says any predictions in this case will be like those made in relation to additional timber dues and ground rent charged by the Government three years and that the present law is so good that the lumbermen doubled their operations. If lumbermen doubled their operations last year they regret it now, because they cannot sell their timber, and the Commissioner will live to scratch a grey head before he realizes the same revenue again. In fact, I predict now that the revenue from woods and forests next year will not be two-thirds what it was last year, and every year it will become perceptibly less. Our mineral resources should be left perfectly free to develop, and when they are sufficiently advanced to bear a tax, that will be the time to raise a revenue from them and not before. I, therefore, move, seconded by Mr. Nantel:—That this House regrets that, instead of reducing the ordinary expenses of administration to its normal figure and thus saving over one and a half million dollars since their advent to power, the Government persists in imposing taxes upon our mines, the development of which is yet in its infancy, thus preventing capitalists from investing their money to assist in the development of our vast interests, and taking away from a large class of laborers a profitable and permanent source of employment. This House regrets also that instead of encouraging the prospector to make new discoveries the Government intends to impose new burdens upon that class of persons, the effect of which will be to stop further prospecting and the development of our mineral resources.

HON. MR. DUHAMEL said the measure was intended to prevent speculation in public lands. Lumber merchants were taxed, and why not miners. The law was not without precedent, as in many countries, even in the United States, such taxes were levied and still the mining industry flourished.

At the second sitting Mr. Duhamel continued for some time, but said little that was new.

HON. MR. BLANCHET followed, and dwelt upon intimate relations that existed between agriculture and the mining industry. The mines procured work for farmers in winter, and thus prevented emigration. So far the mining of phosphate and asbestos were practically the only kinds of mining that were really successful. Last year \$600,000 from this source was paid out as wages, and since it first commenced three millions had been paid out. By imposing this tax the people might be deprived of a source of revenue and the Government would get nothing.

MR. LUSSIER also declared himself strongly against the measure.

MR. ROBERTSON said: I am opposed to taxation of particular industries or the selection of particular branches of trade or commerce and placing taxation on these. Every one should contribute if taxation is necessary. I opposed the tax on commercial corporations on this principle. I am particularly opposed to taxation of those industries engaged in developing the latent natural resources of the province. These ought to be encouraged by every means in our power. To develop our mining industries, which have hardly begun yet, capital is absolutely necessary. Foreign capital is required and should be encouraged to seek our Province. To tax this capital would prevent its seeking investment. To prevent capital from coming here will have the effect of throwing thousands out of employment and obliging our labouring population to work for less wages or leave the country. In either case it will bring distress and suffering on the families of our miners. The tax proposed is unequal. To tax the net profits of any mine might be in some respects admissible, but to tax the gross output of a mine regardless of whether the product costs more to produce it than it is worth at the mines or whether there is a profit in mining, is totally unfair and unjust, upon any fair principle of justice. The ores of our country are mostly of a low grade. Copper often yields only 4 or 5 per cent. to the ton. If that is worth say \$8 per ton at the mine the net profit when manufactured is only \$1 per ton. A three per cent. tax on \$8 is 24 cents and on the profit when manufactured 24 per cent., equal to about 25 per cent. on the net proceeds of a ton of crude ore. More valuable kinds of ore are worth say \$20 a ton at the mine. The tax on this

would be 60 cents. This ore when manufactured might be worth \$10 a ton, making a six per cent. on the net proceed, whereas in the other case it would be 24 per cent. There is no kind of equality in this kind of taxation. It may be said that if mining does not pay people will abandon it; but mining operations are in all countries uncertain, and it is impossible at first to know what is underground and whether the kind of mineral sought for may not be found in greater quantity and richness when more developed. This encourages parties to go on working and gives labour to the miners and support to their families in the meantime. The proposed tax will stop all preliminary examination and working and leave possibly valuable metals undiscovered, which it is in the interest of the country to aid in developing rather than in preventing their full development. He instanced a number of large mining companies which were shipping at a loss. They made large expenditures of capital, employ large numbers of men, pay large amounts in wages, but the quality of the copper is of low grade. It is sent to the United States for smelting purposes, and were it not for the sulphur in the ore used there to manufacture sulphuric acid the works must stop. He wanted the Government to fix the tax for ten years only, so parties would know what to expect, but they refused. The tax may be doubled next year. He wanted to show the House the true state of things and let the Government take the responsibility.

MR. MCSHANE made one of his usual vehement speeches justifying the tax. Speculators were making fortunes out of our mining lands, and could surely bear a little miserable tax. He was glad this tax had been imposed. Government land had been stolen in the past, though it should have been kept for the benefit of the people. These speculators should be made to pay a royalty.

The amendment was lost on a division of 40 to 20, Mr. Lovell voting for the amendment and Mr. Lussier abetting on the ground that he had paired with Mr. Bourbonnais. The bill was then adopted.

At six o'clock the House rose.

Annotated List of Canadian Minerals.*

G. C. HOFFMAN, F. INST. CHEM., ETC.

(Continued from page 165.)

135. IRON SAND—Occurs at St. Mary's Bay, Digby County, Province of Nova Scotia. Considerable deposits of the same are met with at Moisie, Portneuf, Bersimis, Mingan, and Natashquan, in Saguenay County, and at Batiscan, in Champlain County, and elsewhere in the Province of Quebec. It is also found on the shores and islands of Lakes Superior, Huron, Erie, Ontario, and many of the smaller lakes in the Province of Ontario. Mode of occurrence, examination and analyses, T. S. Hunt, Rep. Geol. Can., 1866-69, pp. 261-269.

136. ISERITE—Constitutes a certain portion of the black magnetic sands met with at St. Mary's Bay, Digby County, Province of Nova Scotia, on the north shore and gulf of the St. Lawrence, Province of Quebec, and on the shores and islands of Lakes Superior, Huron, Erie, and Ontario, etc., in the Province of Ontario.

137. JAMESONITE—Is stated to occur near Fredericton, New Brunswick. Prof. Bailey (of the University of New Brunswick) informs me that should such be the case, it would most probably be at the antimony mine in the parish of Prince William (about twenty-five miles from Fredericton), York County, Province of New Brunswick.

138. JASPER—A red and purple striped, and red and yellow striped jasper, is abundant at St. Mary's Bay (Digby Co.), and a red variety is found on Briar Island, in the same county, on Partridge Island (Cumberland Co.), Long Island, and at Woodworth's Cove (King's Co.), in the Province of Nova Scotia. A blood-red jasper, often finely clouded, occurs near Sherbrooke (Sherbrooke Co.), a small bed of dark green and reddish-brown jasper, traversed by small veins of white chalcodony, at River Ouelle (Kamouraska Co.), and a dark red jasper in the township of Hull, Ottawa Co., Province of Quebec. This mineral also enters largely into the composition of the beautiful jasper conglomerate—consisting of pebbles of red and reddish-brown jasper and smoky quartz, thickly imbedded in a white quartzite—which constitutes great beds on the north shore of Lake Huron, Province of Ontario.

139. KALINITE—Is mentioned by Prof. Chapman as occurring in considerable abundance on the exposed faces of some high bluffs of argillaceous shale on Slate River, a tributary of the Kaministiquia, about twelve miles west of Fort William, Lake Superior, Province of Ontario.

140. KAMMERERITE—Is mentioned by Dr. Hunt as occurring, with chromite, in serpentine in the townships of Bolton (Brome Co.), and Melbourne (Richmond Co.), in the Province of Quebec.

141. KAOLINITE—Is met with in masses, sometimes half an inch thick, in fissures in a sandstone of the

Sillery formation, just below the Chaudiere Falls (Lévis Co.). The masses have a greenish or yellowish-white color and are composed of minute soft scales, very unctuous and slightly coherent. (Anal., T. S. Hunt, Geol. Can., 1863, 495). This mineral has also been found in the form of minute pearly scales of a yellowish white color, unctuous and plastic, lining cavities in a rock in the township of Acton (Bagot Co.), likewise in the Province of Quebec. Anal., G. C. Hoffmann, Rep. Geol. Can., 1874-75, p. 314.

142. KERMESITE—Occurs, in small crystalline tufts, with native antimony, stibnite, valentinite and senarmonite, in veins traversing argillite in the township of South Ham, Wolfe County, Province of Quebec.

143. LABRADORITE—Fine examples of this felspar occur in St. Jérôme, Morin—bluish, opalescent, cleavable—Abercrombie, and Mille Isles (Terrebonne Co.), also at Rawdon—as a bluish-white granular homogeneous rock—(Montcalm Co.), and Château Richer—as a pale bluish or greenish-grey rock, with red spots—(Montmorency Co.), in the Province of Quebec. Analyses, T. S. Hunt, Geol. Can., 1863, p. 478; G. C. Hoffman, Rep. Geol. Can., 1874-75, p. 316.

144. LA MONTITE—Is very abundant at Port George, where occasionally veins of three inches thickness are seen intersecting the sides of the cliff, and is also found at Margareville, where it occurs, colored green by copper, Annapolis County, Province of Nova Scotia. Anal., H. How, Am. Journ. Sci., 2 ser., vol. xxvi., p. 30, 1858.

145. LAZULITE—Has been found—massive, of a deep azure-blue color, in narrow veins traversing a greyish-white, in parts milk-white, subtranslucent quartz—three quarters of a mile east of the mouth of the Churchill River, district of Keewatin. Anal., G. C. Hoffman, Rep. Geol. Can., 1878-79, p. 2 H.

146. LEAD—NATIVE—Was observed by Prof. Chapman to occur, in the form of thin strings, in a colorless quartz from the vicinity of Dog Lake of the Kaministiquia, Thunder Bay, Lake Superior, Province of Ontario.

147. LEPIDOMELANE—Has been met with, as an associate of arsenopyrite, in the township of Marmora, Hastings County, Province of Ontario. (See under Addenda.)

148. LIGNITE—Of varying composition, but for the most part of very superior quality, of Cretaceous and Laramie age, is found over very extensive areas throughout the North-West Territories; there are also extensive Tertiary deposits, supposed to be of Miocene age, both on the coast and interior of British Columbia, which in many places contain lignites. For reference to analyses, see under "Mineral coal."

149. LIMONITE—Important deposits of this mineral are met with in Pictou and Colchester Counties, Province of Nova Scotia. As there met with, it occurs in the form of lustrous botryoidal or mammillary and stalactitic masses, which exhibit a fibrous structure when broken; also compact and lustreless, and at other times earthy. Analyses, B. J. Harrington and G. C. Hoffman, Rep. Geol. Can., 1873-74, pp. 231-234.—See also notes to "Bog Iron-Ore," "Iron-ochre."

150. LOGANITE—Occurs, in the form of short thick oblique rhombic prisms of a clove or chocolate-brown color in association with serpentine, phlogopite and apatite, in a white crystalline limestone at the Calumet Falls, Pontiac County, Province of Quebec. Analyses, T. S. Hunt, Geol. Can., 1863, p. 490.

151. LOUISITE—Honeyman, with analysis, Trans. N. S. Inst., vol. v., p. 15, 1879-82. (Needs further examination; free silica is very probably present—Dana, Min., App. 3, p. 70, 1882).

152. MAGNESITE—Has, so far, only been met with in rock masses, forming, in association with serpentine, dolomite and steatite, beds in the townships of Sutton and Bolton, Brome County, Province of Quebec.

153. MAGNETITE—Is found, often beautifully crystallized, in veins in the Triassic trap of King's and Annapolis Counties, in the Province of Nova Scotia. Occurs massive, or disseminated in crystals in dolomite and chloritic slate (sometimes constituting fifty-six per cent. of the mass) in the metamorphic strata of the Eastern Townships of Sutton, Bolton, Ascot, Leeds and Orford; in the Laurentian, in the township of Hull, etc.,—also, in the form of black sand (see note to iron sand), on the north shore of the Gulf of St. Lawrence,—in the Province of Quebec. Forms deposits, frequently of very great extent, among the Laurentian rocks, in the Counties of Frontenac, Hastings, Haliburton, Lanark, Leeds, Peterborough, Renfrew, etc., and is also met with in certain localities on Lakes Superior and Huron, Province of Ontario. Further west, important deposits occur in crystalline rocks, supposed to be of Carboniferous age, in the vicinity of Gillies Bay, south side of Texada Island, Province of British Columbia. Crystals pseudomorph after pyrite, E. B. Kenrick, Ann. Rep. Geol. Can., vol. iii., p. 58 T, 1887. Mineral associations of magnetite, B. J. Harrington, Rep. Geol. Can., 1873-74, p. 194. Analyses, by various analysts, ib., pp. 208-211.

154. MALACHITE—Has, so far, not been met with in characteristic specimens, but merely as an incrustation

on copper ores or in the form of stains and small earthy masses in copper-holding rocks. Of the numerous localities where it has been observed may be mentioned—Spanish River, where some of the quartz veins carrying chalcocite are stained throughout with green carbonate of copper; with galenite in a lode which crosses a long narrow island near the shore at Thunder Cape, Lake Superior, Province of Ontario. In the form of little fibrous masses, with sulphurets of copper, in a drusy calcite at the Black River mine, St. Flavien, Lotbinière County, Province of Quebec.

155. MALACOLITE (DIOPSIDE)—Large twin-crystals of white pyroxene, associated with cinnamon-colored garnets, are found in druses in a pale greenish pyroxene rock in the township of Orford (Sherbrooke Co.), and slender, pale greyish-green colored crystals, sometimes six inches in length, occur imbedded in limestone at the Calumet Falls (Pontiac Co.), Province of Quebec. Crystals of pale greyish-green pyroxene—often replaced on their acute lateral edges, and occasionally several inches in diameter—associated with crystals of dark green pargasite, and black tourmaline, are found at the High Falls and at the Ragged Chute in the township of Blythfield, Renfrew County, Province of Ontario. Analyses, T. S. Hunt, Geol. Can., 1863, pp. 467-468.

156. MANGANITE—Is frequently found associated with pyrolusite at Tenny Cape (Hants Co.) and elsewhere—often crystallized on that ore. It is abundant at Walton and Cheverie, and is met with at Douglas and Rawdon, in Hants County, Province of Nova Scotia. Also occurs on Amherst Island, Magdalen Islands, Province of Quebec.

157. MARCASITE—Has been obtained, by Prof. Chapman, from the walls of a vein holding galenite and chalcopyrite, in the township of Neebing, a few miles east of the Kaministiquia River, north-west shore of Lake Superior, Province of Ontario.

158. MAKEITE—Has been met with in the Triassic trap of North Mountain, Digby County, Province of Nova Scotia, and was also observed by Prof. Chapman in a gneissoid boulder from Bass Lake, a few miles north of Orillia, Simcoe County, Province of Ontario.

159. MELACONITE—Is recorded by Prof. Chapman as occurring, but in traces only, in some of the copper deposits of the Eastern Townships of the Province of Quebec.

160. MELANTERITE—Has been found in some heaps of shale and slack coal at the Glace Bay coal mines, in Cape Breton County, Province of Nova Scotia. Also occurs, in small quantities, in many of the ores from the mineral veins of Lake Superior, Lake Huron, and the Hastings region, Province of Ontario.

161. MENECHINITE—Is found, apparently in a vein-stone of quartz and dolomite, in the vicinity of Marble Lake, in the township of Barry, Frontenac County, Province of Ontario. Anal., B. J. Harrington, Trans. Roy. Soc. Can., vol. i., sec. iii., p. 79, 1882 and 1883.

162. MESOLITE—Occurs, in association with mesolite, in trap rock in the neighborhood of Port George, Annapolis County, Province of Nova Scotia. Anal., H. How, Ed. N. Phil. Journ., new series, vol. viii., p. 207, 1858.

163. MESOLITE—Is found at Port George, and is also said to be very abundant in the North Mountains, Annapolis County, Province of Nova Scotia. Analyses, H. How, Am. Journ. Sci., 2 ser., vol. xxvi. p. 32, 1858.

164. METEORIC IRON—A specimen of meteoric iron, weighing 370 pounds, was found, in 1854, on the surface of the ground, in the township of Madoc, Hastings County, Province of Ontario. Its shape is rudely rectangular and flattened on one side. The surface is irregularly pitted, and coated with a film of dark oxide. The iron is malleable, and highly crystalline in texture. A polished surface when etched by an acid exhibits the so-called Widmannstadt's figures. It contains 6.35 per cent. of nickel; small amounts of the phosphide of iron and nickel (Schreibersite) are disseminated through it, and in making a section of it, rounded masses of magnetic sulphide of iron (troilite?) were met with. Results of its examination by Dr. T. S. Hunt, Geol. Can., 1863, p. 508.

165. MICACEOUS IRON-ORE—Is found in veins in the Cobeguid Hills of Londonderry (Colchester Co.): constitutes an important deposit on the west side of the East River (Pictou Co.): is met with on Salmon River, at Melrose, Manchester, and Roman's Valley in Guysborough County, and at St. Peters, Richmond County, Province of Nova Scotia. Mingled with variable amounts of quartz and chlorite, it constitutes beds of a schistose rock in the townships of St. Armand (Missisquoi Co.), Brome and Sutton (Brome Co.); occurs in small beds in the township of Bristol (Pontiac Co.), and is also met with in the townships of Templeton and Hull (Ottawa Co.), and elsewhere in the Province of Quebec. Forms small beds in Potsdam sandstone in the townships of Bastard (Leeds Co.), and Ramsay (Ianark Co.), in the Province of Ontario.

166. CHROMIFEROUS MICA—Is found in several localities in the Eastern Townships of the Province of Quebec. Minute scales of it occur in the magnesite of

Sutton (Brome Co.), and it has also been observed, in larger plates and imperfect crystals, in a dolomite from Bolton, in the same county.

167. MICROCLINE—Is found in large cleavable masses, in association with quartz, muscovite, albite, etc., constituting a coarse pegmatite vein in the township of Villeneuve, Ottawa County, Province of Quebec.

168. MILLERITE—Is met with in small grains and prismatic crystals, together with minute grains and crystals of a bright green chromiferous garnet disseminated through a white cleavable calcite, in a vein on the east side of Brompton Lake, in the township of Orford (Sherbrooke Co.), Province of Quebec.

169. MINERAL COAL—See under "Anthracite," "Bituminous coal," "Cannel coal," "Lignite."

Analyses, E. Hartley, Rep. Geol. Canada., 1866-69, pp. 365-447—T. S. Hunt, ib., 1871-72, p. 98—B. J. Harrington, ib., 1872-73, pp. 76-81; ib., 1873-74, p. 63; ib., 1876-77, pp. 466-470—G. C. Hoffmann, ib., 1873-74, pp. 90-93 and 188-191; ib., 1875-76, p. 423; ib., 1879-80, pp. 8-14H.; ib., 1882-84, pp. 1-44 M.: Ann. Rep. Geol. Can., 1885, pp. 1-11 M.; ib., 1887-88, pp. 5-20 T.

170. MINERAL RESIN—Is not unfrequently very freely disseminated through some of the coals and lignites of the North-West Territory, in the form of small flattened grains and nodules of a yellow, yellowish-brown or brown color. The nodules do not generally speaking, exceed a quarter of an inch in diameter, but occasionally some of much larger denomination are met with. One from a coal seam on the Middle Fork of the Old Man River, Rocky Mountains (North-West Territory) was found to be a little over an inch and a-half in diameter, and three quarters of an inch thick.

171. MINERAL TAR—Is often seen exuding from the deposits of bituminous sand rock occurring along the banks of the Athabasca River (see note to "Asphaltum"), and in numerous places on the ground at the foot of either bank, or on terraces lower than their summits, this tar collects in pools, or flows in sluggish streams to lower levels. It also occurs at several localities on the shores of the western part of Great Slave Lake; at one or two places on Peace River, and elsewhere in this part of the North-West Territory.

172. MIRABILITE—Occurs at the Clifton gypsum quarry, Windsor, Hants County, Province of Nova Scotia; and, associated with epsomite, as an incrustation upon the cliffs of shale at Fort St. John, Peace River, Province of British Columbia. Anal., G. C. Hoffmann, Rep. Geol. Can., 1875-76, p. 421.

173. MOLYBDENITE—Is somewhat widely distributed, being found, although in most instances only in small quantities, in nearly all the provinces of the Dominion. Some of the most noteworthy localities of its occurrence are those in the Province of Quebec, as—near the mouth of the Quetachon River, in Manicougan Bay, on the north shore of the Gulf of the St. Lawrence, where it occurs disseminated in a bed of quartz six inches thick in the form of nodules from one to three inches in diameter, and in flakes which are sometimes twelve inches broad, by one-fourth of an inch in thickness; at Harvey Hill in the township of Leeds (Megantic Co.), occurring in small rounded masses of fine granular structure, in veins of quartz and bitter-spar; and the township of Aldfield (Pontiac Co.), where perfect and very handsome crystals have occasionally been found, and others, less perfect but of considerable dimensions are met with.

174. MOLYBDEITE—Has been met with in the form of an earthy yellow powder on molybdenite, in the township of Alleen (Pontiac Co.), in the Province of Quebec, and in the township of Ross (Renfrew Co.), in the Province of Ontario.

175. MONAZITE—In the form of a nodular mass, was found at the Villeneuve mica mine, in the township of Villeneuve, Ottawa County, Province of Quebec (Ann. Rep. Geol. Can., vol. ii., p. 11 T, 1886). Dr. F. A. Genth has recently made an analysis of a specimen from this locality, the results of which are given in Am. Journ. Sci., 3 ser., vol. xxxviii, p. 203, 1889.

176. MORDENITE—Occurs imbedded in trap, some two or three miles east of Morden or French Cross, in King's County, Province of Nova Scotia. Anal., H. How, Journ. Chem. Soc., new series, vol. ii., p. 100, 1864.

177. MORENOSITE—Is mentioned by Dr. Hunt as having been observed, as an efflorescence of minute acicular greenish-white crystals, on an ore of nickel from the Wallace mine, Lake Huron, Province of Ontario.

178. MUSCOVITE—Large plates and crystals of this species occur in a vein of graphic granite on Alumette Lake, at Montgomery's clearing, about five miles above Pembroke, Renfrew County, Province of Ontario. It is met with, in association with black tourmaline on Yeo's Island in the Upper St. Maurice (Portneuf Co.), and abundantly, and not unfrequently, in crystals of very large dimensions, in a coarse pegmatite vein (described in note to "Albite"), in the township of Villeneuve (Ottawa Co.), Province of Quebec. A rose-colored mica, closely resembling, if indeed not identical with,

the rose-colored muscovite of Goshen, Mass., has recently been met with by Mr. C. W. Willimott, in the township of Villeneuve (Ottawa Co., P. Que). It was associated with pale green muscovite, in a matrix composed of albite with a little white translucent quartz.

179. NAIL-HEAD-SPAR—Very fine specimens of nail-head-spar are found at Tenny Cape, Hants County, in the Province of Nova Scotia.

180. NATROLITE—Handsome specimens of this mineral are found at Swan Creek (Cumberland Co.), Cape Blomidon (King's Co.), and Gate's Mountain (Annapolis Co.), etc., in the Province of Nova Scotia. It occurs, associated with analcite, in some of the dykes cutting the Trenton limestone at the reservoir extension, Montreal (Hochelaga County.), Province of Quebec. Anal., B. J. Harrington, Rep. Geol. Can., 1874-75, p. 303.

181. NEPHELINE—Is stated, by Dr. Hunt, to occur in white crystals, with small grains of blue sodalite, in the nepheline syenite of Brome Mountain (Brome Co.), it also occurs, as a constituent of a similar rock, at Montreal (Hochelaga Co.), and Belœil (Rouville Co.), Province of Quebec. See also note to "Elaeolite."

182. NEPHRITE—This mineral has been found by Dr. G. M. Dawson, in the valley of the lower Fraser River (British Columbia), in the vicinity of Lytton, on the site of an abandoned Indian village, in small water-worn boulders, evidently derived from the beaches of the River, some having been merely more or less broken, whilst others had been or otherwise partly manufactured into implements (Can. Rec. Sci., vol. ii., p. 364, 1886-87.)

* Fourth paper read before the Royal Society of Canada.

(To be continued.)

The Properties of Nickel Steel.

(Parisian Correspondence to the Ironmonger.)

The contemporaneous researches of English and French metallurgists—notably Mr. Riley, Glasgow, and M. Schneider, Creusot—upon the effect of nickel on steel have had results which seem likely to profoundly influence the future of steel-making. The extraordinary qualities of ferro-nickel have been brought prominently before the metallurgical world by the tests recently undergone in the United States by the Creusot nickel-steel armour-plates and as the outcome of that success it appears that the manufacture of nickel steel will at once be entered upon on an extensive scale. Now that the existence of enormous deposits of the metal has been demonstrated in Canada, the only difficulty is the economical and efficient reduction of the ores. This is claimed to be achieved by a French metallurgist, M. Garnier, who has elaborated a process by which sulphur is completely eliminated from the metal. M. Garnier has, it is stated, concluded a contract with the Canadian nickel mine owners to erect a large smelting works, in which this process will be practically carried on. In this aspect of the nickel-steel question, any information as to the actual composition and capacity of the alloy must be of interest. Such information has just been supplied by M. Charles Walrand, a well-known French steel-works engineer, who claims priority over M. Schneider for the idea of applying nickel to the constitution of armour-plates. The composition of M. Schneider's plates, as well as the special operations of tempering and annealing which are employed in their manufacture are, of course, a trade secret. But M. Walrand gives the composition of the material with which experiments were made, so far back as 1885, at the works of the Société des Forges de Montataire. These experiments were made with the idea that ferro-nickel might be used as a substitute for copper and "white metal" in nearly all its applications; and it was as the result of the information therein obtained that the employment of nickel steel in armour-plates, ordnance, &c., was suggested to the directors of the Ferro-nickel Company and the Creusot Works. The composition of the alloys from which specimens were rolled and tested at the Montataire Works was: carbon, '15 and '05 per cent.; phosphorus, '02 and '04; sulphur and silicon, traces; manganese, '50 and '04; nickel, 25'00; and iron, 74'00. From this metal results were obtained in the testing-machine which were quite foreign to the views up to then entertained upon the characteristics of steel. In round pieces of 6 inches, turned to 4¾ inches, a resistance of 197 lbs. and an elongation of 19 per cent. were obtained before tempering, while the results obtained after tempering were: resistance, 179 lbs.; elongation, 29'5 per cent. In flat pieces of 17 cm. by 6 cm. the resistance for both the tempered and non-tempered metal was less, but the elongation was 40 and 33 per cent. respectively. With round pieces of 10½ inches, turned to 4¾ inches, not tempered at all, the resistance was 196 lbs., and the elongation 43'5 per cent. Other round specimens of 4¾ inches, which were tested without being turned, showed resistance of 152 lbs. and 160

lbs., and elongation of 37 and 40 per cent. M. Walrand does not attempt to deprive M. Schneider of the merit of having pursued his own researches independently of those conducted by the Montataire Company. The main interest of his statement lies in the evidence which it gives of the peculiar properties of steel and nickel when combined in the proportions given above.

Mining Under the Sea in the North of England.—On the 23rd ult., in the presence of many directors and shareholders of the Hodbarrow Mining Company, the final and memorial block of a sea barrier was laid on the northern shore of the Duddon estuary, in the county of Cumberland, at a point where during the last twenty years an important mine, producing a large quantity of rich red hæmatite iron, has been worked. This mine is owned by the company, who are the proprietors of the land, the mineral rights being leased to them by the Earl of Lonsdale. The ore having been won as close to the sea margin as it has been possible to work without letting down the surface of the land and admitting the influx of the sea, thereby drowning the mine, the company have recently obtained a fresh lease from Lord Lonsdale, undertaking to construct a barrier to keep back the sea along that portion of the estuary in front of the mine, in order that they might win the ore from underneath some twenty-six acres of the sea bed. To effect this object a massive and substantial sea barrier has now been constructed. This great sea barrier is just two-thirds of a mile in length, and for about one-half of this length is fully 50 feet in height from the bottom of the foundation to the top of the parapet. The engineer of the work is Sir John Coode, and the contractors are the well-known firm of Messrs. Lucas and Aird. There is every reason to believe that the anticipation of the directors and shareholders of being able to continue the working of the iron ore over a further period of twenty-five years may be realized, thus giving employment during that time to about 1,500 men.

A Model Coal Shaft.—The new Standard shaft of the H. C. Frick Coke Company, which was visited by the members of the American Institute of Mining Engineers and their foreign guests, was built four years ago by Robert Ramsay, the present superintendent, and is considered the finest of its kind in the world. From its neat arches at the coal bottom to the self-acting tippie, more than 300 feet above, and from the five big batteries of boilers to the immense direct-acting engine there is an air solidity and strength about the whole thing that speaks louder than mere words about the ability of the designer and builder. In April last a test run was made at this shaft and the result was the breaking of the world's coal hoisting record that had been made some time before by the famous Nottingham shaft, near Wilkes-barre. This now famous hoist at the Standard began at 6 o'clock in the morning, and in eight and a half hours' actual running time 1,259 sixty-hushel waggons, or over 3,021 tons, were hoisted. These, more than 75,000 bushels, when turned into coke, would load 120 cars, allowing seventeen tons to the car. Throughout the entire mine the working of the men is systematized to the minutest degree, and every precaution is taken for the safety of the toilers. That Mr. Ramsay's efforts to have a safe mine have met with success is proved by the very small number of accidents that have occurred in it. The immensity of the work and its completeness of detail brought forth words of highest praise from the visiting party.

Gold Mining Supplies.

The principal depot in Nova Scotia, carrying the most complete assortment of first class goods, is

H. H. Fuller & Co's,

41 to 45 Upper Water St., Halifax, N.S.

Our line comprises Explosives, Fuse, American and English Mill and Hammer Steel, Bar and Bolt Iron, Steel Wire Hoisting Rope, Hemp and Manilla Rope, Rubber and Leather Belting, Miners' Candles, Oils and Lamps, Miners' Tools, Machinists' Tools, Blacksmiths' Tools, and every requisite for the gold miner.

H. H. FULLER & CO.,
Halifax, N.S.



\$6000.00 a year is being made by John R. Goodwin, Troy, N.Y., at work for us. Reader, you may not make as much, but we can teach you quickly how to earn from \$5 to \$40 a day at the start, and more as you go on. Both sexes, all ages. In any part of America, you can commence at home, giving all your time, or spare moments only to the work. All is new. Great pay \$1 RE for every worker. We start you, furnishing everything. EASILY, STEADILY learned. PARTICULARS FREE. Address at once, STINSON & CO., PORTLAND, MAINE.

MONEY

can be earned at our NEW line of work, rapidly and honorably, by those of either sex, young or old, and in their own localities, wherever they live. Any one can do the work. Easy to learn. We furnish everything. We start you. No risk. You can devote your spare moments, or all your time to the work. This is an entirely new lead, and brings wonderful success to every worker. Beginners are earning from \$25 to \$50 per week and upwards, and more after a little experience. We can furnish you the employment and teach you FREE. No space to explain here. Full information FREE. TRUE & CO., AUGUSTA, MAINE.

\$3000

A YEAR! I undertake to briefly teach any fairly intelligent person of either sex, who can read and write, and who, after instruction, will work industriously, how to earn Three Thousand Dollars a Year in their own localities, wherever they live. I will also furnish the situation or employment, at which you can earn that amount. No money for me unless successful as above. Easily and quickly learned. I desire but one worker from each district or county. I have already taught and provided with employment a large number, who are making over \$3000 a year each. It's NEW and SOLID. Full particulars FREE. Address at once, E. C. ALLEN, Box 420, Augusta, Maine.



Snug little fortunes have been made at work for us, by Anna Page, Austin, Texas, and Jno. Dunn, Toledo, Ohio. See cut. Others are doing as well. Why not you? Some earn over \$500.00 a month. You can do the work and live at home, wherever you are. Even beginners are easily earning from \$5 to \$10 a day. All ages. We show you how and start you. Can work in spare time or all the time. Big money for workers. Failure unknown among them. NEW and wonderful. Particulars free. H. Hallett & Co., Box 880 Portland, Maine.

Sudbury Nickel Deposits

The January issue of the Canadian Mining Review will contain verbatim the report by COMMANDER WM. M. FOLGER and LIEUTENANT H. H. BUCKINGHAM to the Hon. B. F. TRACEY, Secretary to the United States Navy, Washington, on the Sudbury Mines and Nickel Deposits.

Parties desiring extra copies of this special number must order them in advance. Price per copy, 15 cents.

GEO. A. SPOTSWOOD, C.E.,

Mining Engineer,
KINGSTON, ONTARIO, CAN

Mines and Mineral Properties Examined
and Reported on or Negotiated.
Explorations and Exploitations Conducted.

SPECIALTIES:
IRON, NICKEL AND PHOSPHATE.



Money Orders.

MONEY ORDERS may be obtained at any Money Order Office in Canada, payable in the Dominion and Newfoundland; also in the United States, the United Kingdom, France, Germany, Austria, Hungary, Italy, Belgium Switzerland, Portugal, Sweden, Norway, Denmark, the Netherlands, India, Japan, the Australian Colonies, and other countries and British Colonies generally.

On Money Orders payable within Canada the commission is as follows:

If not exceeding \$4	2c.
Over \$4, not exceeding \$10	5c.
10, " "	20c.
20, " "	40c.
40, " "	60c.
60, " "	80c.
80, " "	100c.

On Money Orders payable abroad the commission is:

1 not exceeding \$10	10c.
Over \$10, not exceeding \$20	20c.
20, " "	30c.
30, " "	40c.
40, " "	50c.

For further information see OFFICIAL POSTAL GUIDE.

Post Office Department, Ottawa.
1st November 1889.



North-West Mounted Police.

RECRUITS.

APPPLICANTS must be between the ages of Twenty-two and Forty, active, able-bodied men of thoroughly sound constitution, and must produce certificates of exemplary character and sobriety.

They must understand the care and management of horses, and be able to ride well.

The minimum height is 5 feet 8 inches, the minimum chest measurement 35 inches, and the maximum weight 175 pounds.

The term of engagement is five years.

The rates of pay are as follows:—

Staff-Sergeants \$1.00 to \$1.50 per day
Other Non-Com. Officers.. 85c. to 1.00 "

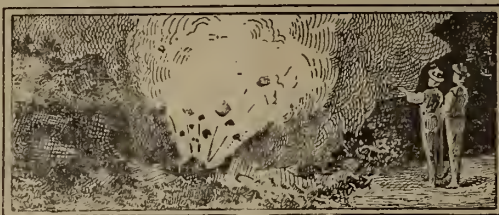
	Service pay.	Good conduct pay.	Total.
1st year's service,	50c.	—	50c. per day
2nd "	50	5c.	55 "
3rd "	50	10	60 "
4th "	50	15	65 "
5th "	50	20	70 "

Extra pay is allowed to a limited number of blacksmiths, carpenters and other artisans.

Members of the force are supplied with free rations, a free kit on joining and periodical issues during the term of service.

Applicants may be engaged at the Immigration office, Winnipeg, Manitoba; or at the Headquarters of the Force, Regina, N.W.T.

Standard Powder Company



MANUFACTURERS OF ALL KINDS OF

GLYCERINE EXPLOSIVES

—FOR—

MINING

—AND—

RAILROAD WORK.

ADDRESS—

W. H. HARRISON,

MANAGER,

BROCKVILLE, ONT.

LEDOUX & COMPANY,

10 CEDAR ST., NEW YORK.

Engineers, Metallurgists & Assayers.

Public Ore Sampling & Storage Works

All the principal buyers of furnace materials in the world purchase and pay cash against our certificates of assay, through New York banks.

By special permission of the Secretary of the Treasury of the United States, cars of ore or copper matte passing through in bond can be opened and sampled at our works.

Consignments received and sold to highest bidder. Send for circular giving full particulars.

Mines examined and sampled. Assays and Analyses of all kinds.

HARRIS & CAMPBELL

Latest Designs in Drawingroom, Diningroom

and Bedroom

FURNITURE

With improved Steam Machinery our facilities for manufacturing Cabinet Goods are complete. Our upholstery Department is well stocked with latest imported patterns.

Corner **QUEEN & O'CONNOR Sts.**
OTTAWA.

SOCIÉTÉ

Canadienne d'étude Minières

CAPITAL, - - \$100,000

Assaying, Prospecting and Mining.

HEAD OFFICE, - - - 30 St. FRANCOIS XAVIER ST

P. O. Box 1625, MONTREAL.

Office in Paris (France) 12 Place Vendome.

DIRECTORATE:

M. SCHWOB, Vice-Consul of France, *President*
JOHN S. HALL, Q.C., M.P.P., *Vice-President.*
C. A. DUGAS, Judge of Sessions }
C. H. A. GRANT, *Directors.*
C. DUQUET, Alderman, Quebec, }
G. WERNER, *Secretary and Treasurer.*
L. DE LA VALLEE POUSSIN, I.C.P. }
JOHN D. FROSSARD, M.E. } *Consulting Engineers.*
JOHN S. HALL, Q.C., M.P.P., Advocate, Legal Adviser of the E.

CANADA ATLANTIC RAILWAY.

THE SHORTEST PASSENGER ROUTE BETWEEN

Ottawa & Montreal

AND ALL POINTS EAST & SOUTH.

The only road in Canada running trains lighted with electricity and heated by steam from the engine. Luxurious Buffet Pullman Palace Cars on all trains between Ottawa and Montreal. Only line running through Sleeping Cars between

OTTAWA, BOSTON AND NEW YORK

And all New England and New York points.

Baggage checked to all points and passed by Customs in transit.

For Tickets, Time Tables and information apply to nearest agent or to S. EBBS, City Passenger Agent,

GEO. H. PHILLIPS, Gen. Agent, 24 Sparks St., OTTAWA, VALLEYFIELD.

A. E. CAIRNS, General Agent,

136 St. James St., MONTREAL

Or at 260 Washington St., Boston, and
317 Broadway, New York.

E. J. CHAMBERLAIN, C. J. SMITH,
General Manager, General Passenger Agent
General Offices, Ottawa.

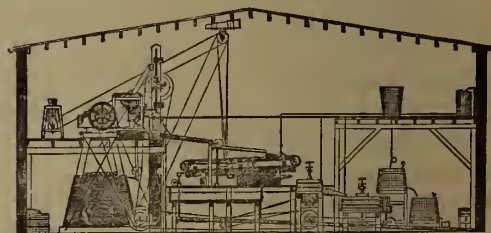
Charles M. Rolker,

— LESSEE, —

New York Ore Milling & Testing

WORKS.

Office, - - 18 Broadway, New York.



Cable Address:—PHAFTRY, New York.

Consulting Mining Engineer.

Examinations made and reports rendered of mines and mining property, metallurgical works and processes.

Ores can be practically tested by any known process and the necessary plan of reduction determined. Works are complete in every respect for practical testing of Gold, Silver and Concentrating Ores and Tailings. ANALYSIS of ores and furnace products, etc.

BELL TELEPHONE CO.

OF CANADA.

ANDREW ROBERTSON, *PRESIDENT*
C. F. SISE, *VICE-PRESIDENT*
C. P. SCLATER, *SECRETARY-TREASURER*

HEAD OFFICE, - MONTREAL.

H. C. BAKER, *Manager Ontario Department*
HAMILTON.

This Company will sell its instruments at prices ranging from \$10 to \$25 per set. These instruments are under the protection of the Company's patents, and purchasers are therefore entirely free from risk of litigation.

This Company will arrange to connect places not having telegraphic facilities with the nearest telegraph office, or it will build private lines for firms or individuals, connecting their places of business or residences. It is also prepared to manufacture all kinds of electrical apparatus.

Full particulars can be obtained at the Company's offices as above, or at St. John, N.B., Halifax, N.S., Winnipeg, Man., Victoria, B.C.

